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July 10, 1920

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by Douglas Lay

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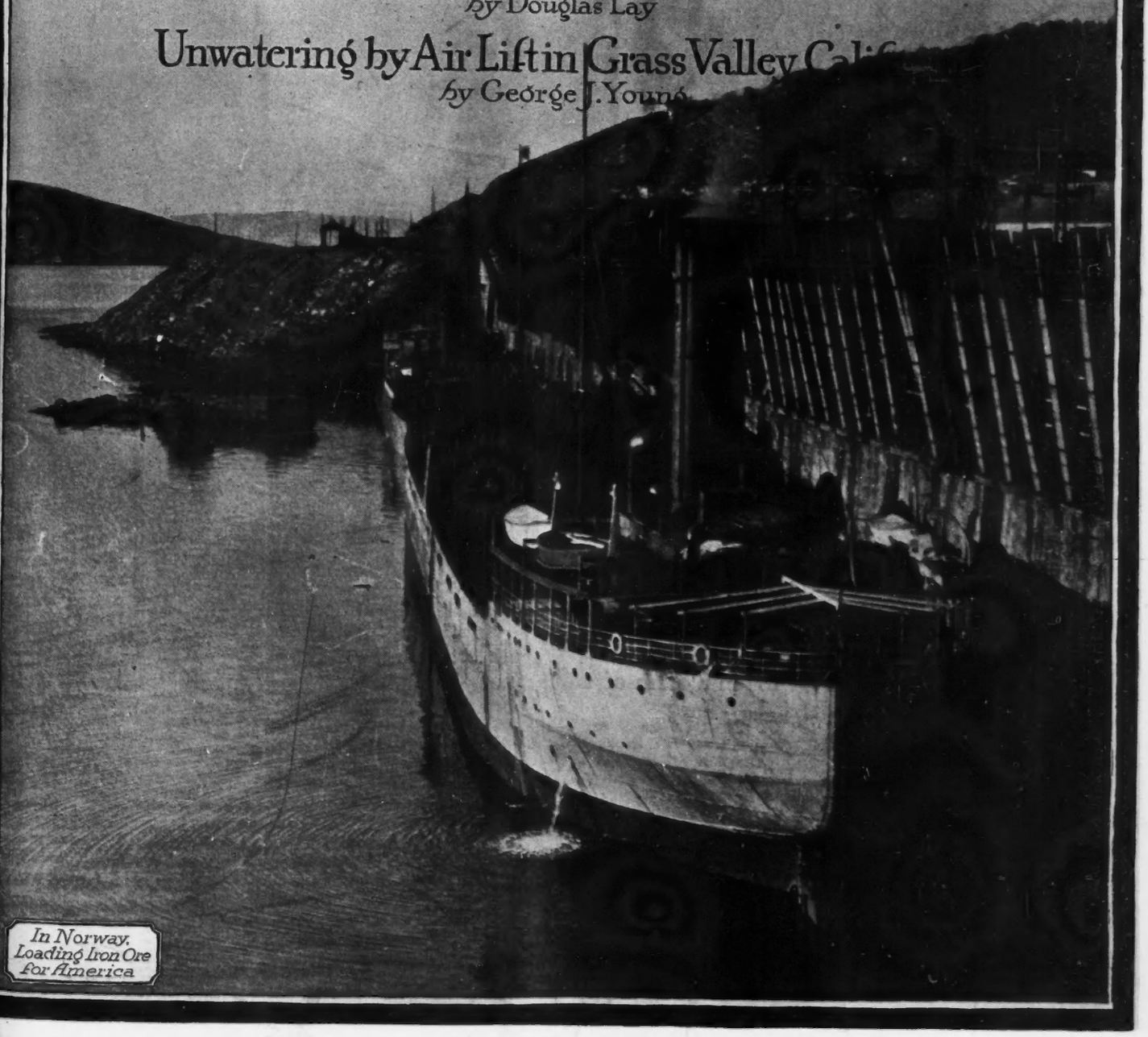
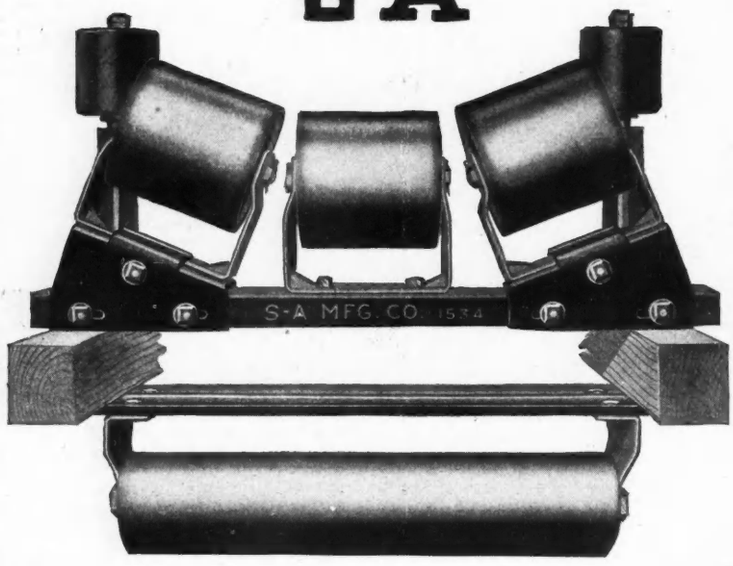
by George J. Young



In Norway, Loading Iron Ore for America

S-A



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A Weekly Journal of the Mining and Mineral Industries

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Volume 110 New York, July 10, 1920 *Number* 2

America an International Miner

THE international aspect of American statesmanship has been preceded by a steady development of international character in the intellectual, social, and economic life of the United States. The machinery of government is only trying to adjust itself, with vast creakings of rusty and inactive parts, to a national condition. No truer example can be shown of the fact that the government does not direct the people, but that the people lead the government, in a democracy, than is disclosed by consideration of this fact.

We are an international people—probably no nation more so. We are international in our population and in our sympathies; we represent in a way within our own borders a prototype of the sometime World Republic, for men of all creeds and of all tongues live here together and work together in harmony. Whatever strivings and jostlings we may endure are not based upon national or racial prejudices or advantage.

Our business enterprise, the use of our capital, the play for the genius of our constructive builders and organizers, have long since leapt our boundaries. This is shown strikingly in our mining industry, which which has become within a decade almost as international as that of England, and will be inevitably so in the future. In this national growth we want only fair play and equal rights, such as we expect at home: no American has any desire to have his government help him "hog" a province or a state, or help him to a monopoly anywhere. Our intrepid adventurers in mining are at work in all the continents: even in old Europe they are developing mines with American-born experience and with American breadth of operation.

Everywhere American capital and mining enterprise are welcomed by the peoples, because our record shows that behind these there does not tread the ominous shadow of political domination. Jugo-Slavia sends to us an invitation and appeal for us to develop her mines. China trusts us, and looks to us as a model. Even distracted Siberia calls for our capital and our engineering skill in developing her great mineral wealth. We shall soon publish original articles embodying these requests. Not only Armenia has called for us, but even the Turks trust our fairness above that of all other nations, and would gladly welcome our guidance and our enterprise.

We can be, through our pioneering skill, the missionaries of the new democratic order of the world, more than we can with books or with statecraft. For the clear vision there can be no doubt, if one looks through the confusing murk of personalities and the back-and-forth swirling of imperfect political activities, of the forward progress of America, expressed, not by this President or that, but by the great powerful mass of Americans, evolving out of what seems at times confusion, a continually better and stronger form. We are reaching out for trade and for fields for our enterprise in all parts of the world, not from unworthy motives, but because it will be the spirit of the world for all nations to do this: for thus only can the greatest average efficiency and the maximum individual welfare be obtained. Our future development in South America will be most marvelous, and the result will be that the South American republics, instead of being put under a protectorate, governed and restricted for foreign political purposes, will become more powerful, advanced, and independent. That is the trend of our special genius, which no other country has yet attained. However much the tantalizing chaos in Mexico may have tried our patience we must conserve this ideal for Mexico also—that our influence (which should be stronger than we have made it) must be directed toward ultimately building up the dignity, stability, and independence of our sister republic. We want no more territory.

American capital is now developing vast copper deposits in South America, which may ultimately switch the world's center of copper production to that continent; and it is active in silver mining and in tin mining. In Asia it is reaching out in dredging fields for gold and tin, and planning the development of other mineral resources.

Our mining people should realize fully this international nature of our industry, and consider well whether tariffs protective of those portions of our mining industries which lie within our political boundaries are going to be beneficial, or prejudicial, to the whole industry in the long run. What would England gain by tariffs designed to force at an unnatural pace the mineral wealth of Great Britain—by putting a big tariff on the importation of tin from outside of England, for example? It would be a step toward commercial and national ruin. In the new rôle into which we have grown, the same principle will often apply. Rather the question of absolute efficiency will be found to be paramount—where can we buy or produce a certain metal cheapest, and where can we dispose of it to the best advantage?

It is not a question of cheap or high-priced labor: this is a minor element in these problems. A great American company operating in South America is engaged in far-sighted plans of educating its workmen to better things—to more expensive tastes, in a way—knowing and planning that this development will mean increased wages; but those directing it know that the increased efficiency of better and stronger men will more than offset the outlay. It is a question of full utilization of natural advantages—volume of ore, available power, ease of transportation—all inanimate things, which it is for the good of mankind to exploit to the maximum.

The Major Metal Quotations

WE HAVE before editorially sketched out the problem of the quotations of the major metals, and described the ways in which the various more or less independent quotations are obtained. We have described the method by which the *Engineering and Mining Journal* quotations are reached, why they are by far the best approximations of the actual average prices, and why they are necessarily lacking in perfection. We do not need to recur to this exposition, referring the readers to our issues of Feb. 7, 14, 21, and 28.

Journalism and the metal market were apparently relatively primitive when the *Journal* was founded. To this day, quotations for the minor metals and minerals are necessarily computed by consulting those dealers who are familiar with the market, and reflecting the average of the information obtained from them. In some instances, only one organization has the necessary data and oversight of the whole situation. Apparently, the major metal market was in somewhat this stage of development when the *Journal* was founded, and we understand that in the beginning its quotations were practically obtained from a single source. This situation obtained, we believe, virtually up to the administration of our immediate predecessor, who undertook to broaden the range of sources, so as to make it representative, and by averaging up data from various sources to arrive at an independent quotation. This system has been inherited and followed by the present administration, and has been expanded by the addition of further sources and checks. Thus a better and better approximation is being achieved. We have been successful in quoting prices which have been approved as substantially correct by those familiar with the market, both sellers and buyers.

In the long run, however, no approximation is satisfactory to our desires as engineers, and the trend of our efforts has been toward making the quotations exact. For this there is no machinery; moreover, we find certain sectors of the market, particularly in copper and lead, shut off (as they always have been) by the secretive policy of some powerful groups of producers. That is, certain elements which make up the market, and constitute in fact the majority factor in metals, co-operate closely with the *Engineering and Mining Journal;* but certain important factors avoid adequate and accurate co-operation.

We have carried this matter of increased accuracy as far as we can, and we do not regard the situation as satisfactory.

We recommend most strongly to the component factors in the metal market that they devise a method of establishing exact quotations. The *Engineering and Mining Journal* need not be considered in any such arrangement. We shall continue to quote metal prices—we have always done it, and we always shall; but we honestly would prefer not to quote as an "original authority." We shall proceed without interruption on our established methods; and if our prices are still accepted as authoritative, and official, we can only approve, as they are by far the best that can be had; but we earnestly recommend the establishment of a statistical clearing-house among metal producers, whereby the exact daily average of the metal markets can be computed statistically, without the gaps which dissatisfy us. The *Engineering and Mining Journal* would take pleasure in quoting figures so determined, and would take more pleasure in pointing out any defects in such an outside estimate than it does in criticising its own. There is no sufficient reason, it seems to us, why we should indefinitely continue to assume the responsibility of appraising the market.

Nickel Coinage in Australia

A RECENT message from Sydney states that Australia is about to join the great majority of the nations and colonies not only of the Northern but of the Southern Hemisphere, and introduce nickel coins in her subsidiary currency. A dispatch published in the New York *Journal of Commerce* indicates that the new pennies and half-pennies of nickel will go into circulation concurrently with the present copper coins, but that no more of the latter will be minted.

All who have had practical experience in the relative neatness, cleanliness, and convenience of small nickel versus clumsy copper coins—and those who have traveled first in England and then in Belgium or Germany could hardly escape it—will congratulate the Australian public on this great improvement.

However, the new Australian coins are to follow the general lead of India, Ceylon, and the Straits Settlements, where the corresponding coins are cut square, with rounded corners. It is supposed that Australia's choice of a square shape was in consideration of the economy it offers when cutting blanks from the metal sheets and in packing better when boxed. But blanks of hexagonal shape do not waste much metal, pack just as closely as squares, and offer a blunter angle than the square pieces. Perhaps the Indian government recognized the disadvantageous features in the square 2-anna nickel piece, for in 1908 the government minted its wavy-edged 1-anna nickel coin, which has twelve curved corners in place of four.

Incidentally, Australia's decision to use nickel for subsidiary coins will increase the demands on New Caledonia and British America nickel mines, at the same time relieving somewhat the copper situation in Australia. According to the large work published by the Mond Nickel Co., Ltd.; in February, 1918, the economy that would be effected by decimalizing and substituting nickel for bronze in the coinage of the British Isles would give a profit of over half a million pounds sterling annually.

The Vanishing Gold Premium

NOT so very long ago the gold miners of South Africa were jubilant over the substantial premium they were receiving for their gold product. They had good reason for rejoicing, as one of the peculiar results of the economic readjustment following the war left them in a position to take advantage of the depreciated currency of their mother country. By selling their gold in a free market they were indirectly able to obtain more of their own depreciated paper currency in return for their gold bullion, a gold premium, so to speak, the amount depending upon, and see-sawing with, the foreign exchange value of the pound sterling. That this premium was not intangible, the increased value of the Rand mining stocks and the steady or increased gold output from that region attested.

The premium started at about 16 per cent, and, as the value of the pound sterling diminished, increased to 44

per cent—a gratifying compensation for the lean war years. Of late, sterling has been advancing, and consequently the premium has dropped, although it is still an appreciable factor.

Jubilation has turned into concern among the gold producers who are affected, for, faced with a possible further rise in the exchange value of sterling, the gold premium may conceivably become a negligible factor in stimulating production in the near future. Should this take place, the South African gold-mining industry will again be faced with the familiar gold miner's difficulties encountered during the war. Whether resort could then be had to legislation similar to that proposed in the United States at the present time, creating an excise tax on gold entering into the arts, is problematical.

The gold question was thoroughly discussed in South Africa by various commissions appointed for the purpose during 1918 and 1919, with no plan for substantial relief suggested. In fact, one of the strong points made in a report upon the subject laid considerable stress upon the advantage gold miners possessed in normal times in the steady price for their product.

The local South African technical press does not suggest, so far as we know, any plan like that embodied in the McFadden Bill, favoring the gold bonus. Instead, governmental assistance to lighten the gold miners' burden through easing of taxes is proposed. Appeals are addressed to the gold miners themselves, to increase the efficiency of their work, for South Africa has not been immune to the lamentable and universal decrease in labor efficiency during the last few years, and undoubtedly an increase in the willingness of labor to do its share, coupled with governmental aid in lowering taxes, will go far to cure existing troubles in this critical and absorbing situation in the world's foremost gold-producing district.

Public Schools and the Mining Camp

FOLLOWING the cry raised by many salaried workers in protest against inadequate compensation, the U. S. Bureau of Education points out the seriousness of conditions in the public schools and insists that they must be given consideration if the schools are to continue their present high standard. From the replies to inquiries made by the Bureau we learn that not fewer than fifteen thousand teaching positions in public high schools will be without properly qualified teachers next September.

It is fair to assume that the greater proportion of the shortage is due to the fact that more adequate compensation is offered in other branches of employment, and that many who might choose teaching as a vocation have been attracted elsewhere. For this, of course, there can be but one remedy unless the alternative of employing persons below the standard prescribed by experience and general practice is adopted. And this at best would be only putting off the evil day.

To a mining community the public school represents a power for good, and embodies the opportunity for the development of the highest type of citizenship. It is doubtful if any individual institution exerts a greater influence, and a tendency to keep this influence on anything but a high plane should not be condoned. Diversified interests are of course to be expected, and a mining community, in common with any other, embraces its cliques, its divisions, and its groups, all of which form combinations that make for separate lines of thought and detract to a great extent from the "get together" idea. Public-school activities have always offered the opportunity for a common ground; the school is the open forum, the nucleus of democracy, and the means whereby all factions can combine in a mutual purpose—that of the up-building of the citizen.

Probably no other industry contains a greater percentage of different nationalities than does mining, and this fact makes it all the more necessary that those who have the responsibility of the public-school guidance in mine communities should realize that the personnel must be of the best in order to meet conditions, which differ from other communities where the population is less mixed. It is a commendable fact that in districts where the mine operators have adopted a broad policy, and have taken a lively interest in public affairs, the schools are of a high order and every effort is made to procure high-grade teachers. The increased expense which has been necessary to maintain the schools under present-day conditions has been met cheerfully, with the realization that such institutions are most essential to the promotion of the public weal. In other districts where the tendency has been to curtail public-school expenses in anticipation of a recession of living costs, it is to be hoped that a realization of such a "penny wise, pound foolish" policy will come before it is too late.

The White-Collar Boys

A WHIMSICAL writer in one of the New York dailies observed that he found the economic problem simple for himself, if frankly viewed: If houses are high, don't buy them; sell them. If wages are too high, go to work and earn them. If stocks are too low, buy them; if they are too high, sell them.

Possibly some of this whimsical philosophy might help some of the white-collar class who find themselves between labor and capital, receiving lower wages and obliged to live more expensively than the class commonly denominated labor. If the clerk finds the house painter is getting double his pay, and can work in overalls, according to our writer's philosophy, he would see in it only an opportunity. Moreover, if he looks into the opulent labor class, he would find that many of these well-paid men have work that requires more training, skill, and intelligence than the work he himself does. He would find, in short, that the law of supply and demand is still working, and not a violation of it; and when there are more volunteers for a certain class of work, the price comes down. Most of the jobs he will, however, not volunteer for—although they may require more intelligence than his own job. He will find them, frankly, too strenuous.

This is the philosophy of a lot of our red-blooded college boys these days, in vacation time and after graduation. Finding labor well paid, they are reaping the benefits exultantly, and building thereon for their future career.

Money is only part of the consideration of any job. You are paid also, in certain jobs, by protection from the weather, or from dirt, by freedom from physical exertion, by convenient arrangement of work hours, and by the association with polite people. If all or any of these, plus the wage, isn't enough, the young man can usually get a larger wage by substituting cash for one of the valuable perquisites of his former job.

WHAT OTHERS THINK

The Lena Gold Mining Co., Siberia

I note in the issue of Jan. 10, 1920, of the *Engineering and Mining Journal*, statements by R. S. Botsford, in his article, "Mining Conditions in Russia," concerning the Lena Gold Mining Co.

I want to make clear the reference to the above-named property. The English company is known as "The Lena Goldfields"; the Russian company is "The Lena Gold Mining Co."

In 1915 I was employed by the Russian company to sample and advise with a view to improved methods of operation, i.e., using more mechanical and up-to-date methods. During 1916 and 1917 I was acting as consulting engineer in this work.

The facts are these: We proved during the three years 98,000,000 cu.yd. of dredgeable material, averaging value 31.2c. per cu.yd. The estimated costs were as follows:

	Cents per Cu.Yd.
Labor	.006
Power	.03
Amortization	.059
Repair	.024
Management	.05
Total	.169

This is about three times our costs at Dawson for the same kind of work.

The amount of proven ground would be equal to three 18-cu.ft. dredges with a life of thirteen years each. These were recommended, and one was ordered, and at last accounts was lying at Milwaukee, Wis., with the Bucyrus people, crated ready for shipment. The other two were advised, but, owing to conditions in Russia, orders were not placed.

These are the facts in the case, and I hope you will publish them. W. E. THORNE.

Maraguta, Northern Nigeria.

The Shannon Tailings and SO_2 Leaching

Referring to Mr. van Barneveld's letter published in your issue of May 22, I desire to state on behalf of the Shannon Copper Co. that that company is in no way responsible for any statements appearing in the article on "Leaching of the Shannon Tailings," contributed by W. L. Maxson, or, therefore, for deductions based thereon, in your editorial in the issue of April 10. I desire, however, to add that Mr. Maxson had the company's sanction to write an article, for publication, on his own views of the subject.

What appears to be known as the SO_2 process was tried on Shannon tailings by Messrs. Leaver and van Barneveld. The results were encouraging. Over 90 per cent of the *oxidized* copper contents was easily extracted. I thought so well of the possibilities of this process, in solving our very difficult problem, as to obtain permission of the directors of this company and enter into an understanding with the Bureau of Mines to erect a twenty-five-ton experimental plant. The fact that such had not been constructed before closing our operations in the Clifton district had no relation whatever to my opinion of the merits of the process.

The statement made in the same editorial regarding the Slater process is also misleading. This process was the most successful, metallurgically, of all that had been applied to the treatment of the Shannon tailings and low-grade semi-oxidized ores. That no experimental plant was erected was due entirely to the fact that in my opinion it did not offer possibilities of being commercially successful under our conditions, and did not reflect on the adaptability of the process to the treatment of our ores and tailings.

J. W. BENNIE,
General Manager
Gleeson, Ariz. Shannon Copper Co.

[The editorial referred to in this and Mr. van Barneveld's letters stated that none of the processes formerly tried on the Shannon ores had been successful. What was meant was that they had not been *commercially* successful, or that the tests had not offered sufficiently attractive possibilities of commercial success to be adopted.—EDITOR.]

More Hints to the Troubled Cyanider

In reference to your article by J. A. Carpenter, entitled "The Troubles of a Cyanider," in your issue of May 29, 1920, I wrote a short article which was published in *Mining & Scientific Press* in December, 1918, in which I tried to point out the fact that a cyanide solution will attack copper phosphate, taking the copper into solution and the phosphate forming an alkaline phosphate.

The action of nascent hydrogen in the zinc box, formed at the time of precipitation of the precious metals, tends to form a phosphine from the alkaline phosphate. This phosphine attacks the gold solution, precipitating the gold in a fine amorphous state and also, in combination with phosphorus and oxygen, as a flocculent grainy precipitate.

In many plants there is a selective precipitation in the zinc boxes; i.e., at the head of the box the gold precipitates out, then the silver, next copper, antimony, arsenic, and other metals, which I believe is caused by the presence of these alkaline phosphates.

In three different plants with which I have been associated there has been serious trouble with the precipitation. I know that ore from parts of each mine carried considerable copper phosphate, and whenever that was encountered, our trouble was plenty.

My tests, using these solutions in a small test plant where the pregnant solution was pumped up into a storage tank (an emulsion of zinc dust being also fed to the intake of the pump), showed that the precious metal was practically all removed, together with nearly all of the copper and most of the other base metals, and I think those having precipitation troubles will be a long way on the road to freedom from such if they try to utilize zinc dust instead of the shavings.

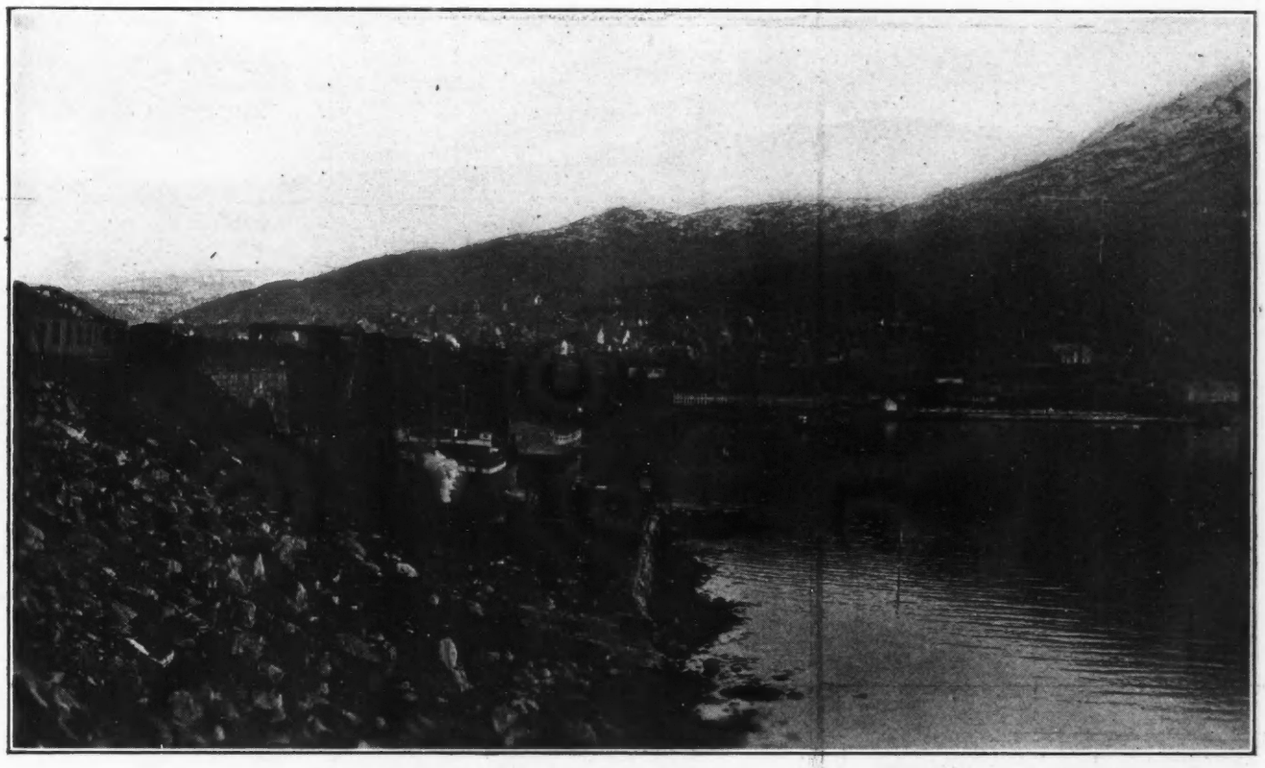
Phoenix, Ariz. GEO. D. DIEHL.

The Swedish Iron Mines of Kiruna and Gellivare

Large Reserves of High-Phosphorus, High-Iron, Magnetic Ores, Situated Above the Arctic Circle Offer Favorable Mining and Marketing Conditions—Open-cut and Underground Methods Followed by Crushing and Magnetic Separation

BY CHARLES W. BOISE
Written for *Engineering and Mining Journal*

IN OCTOBER, 1919, it was my privilege to make a casual visit to the famous Swedish iron mines of Kiruna and Gellivare. The following summary describes the main aspects of the deposits, and presents a record of recent operations in that renowned district.



GENERAL VIEW OF THE TOWN AND DOCKS, NARVIK, NORWAY

The Kiruna and Gellivare mines are situated in northern Lapland, Sweden, above the Arctic Circle. The two deposits are analogous in many respects. The ore at both mines is principally magnetite, with small amounts of apatite. The Kiruna deposit forms a dike-like mass which lies at a steep angle between walls of quartz porphyry and syenite porphyry. The Gellivare deposit occurs under similar general conditions, except that the rocks have been metamorphosed and have developed a schistose character.

The railway connecting the port of Narvik, on the Norwegian coast, with Luleä, on the Gulf of Bothnia, passes by both mines. This line connects at Boden with the line from Stockholm to Haparanda. Gellivare lies nearer Luleä, through which the majority of its output is shipped. Narvik is the shipping point for Kiruna ore. Both mines are controlled by the same group, the Trafiktiebolaget Grängesberg-Oxelösund.

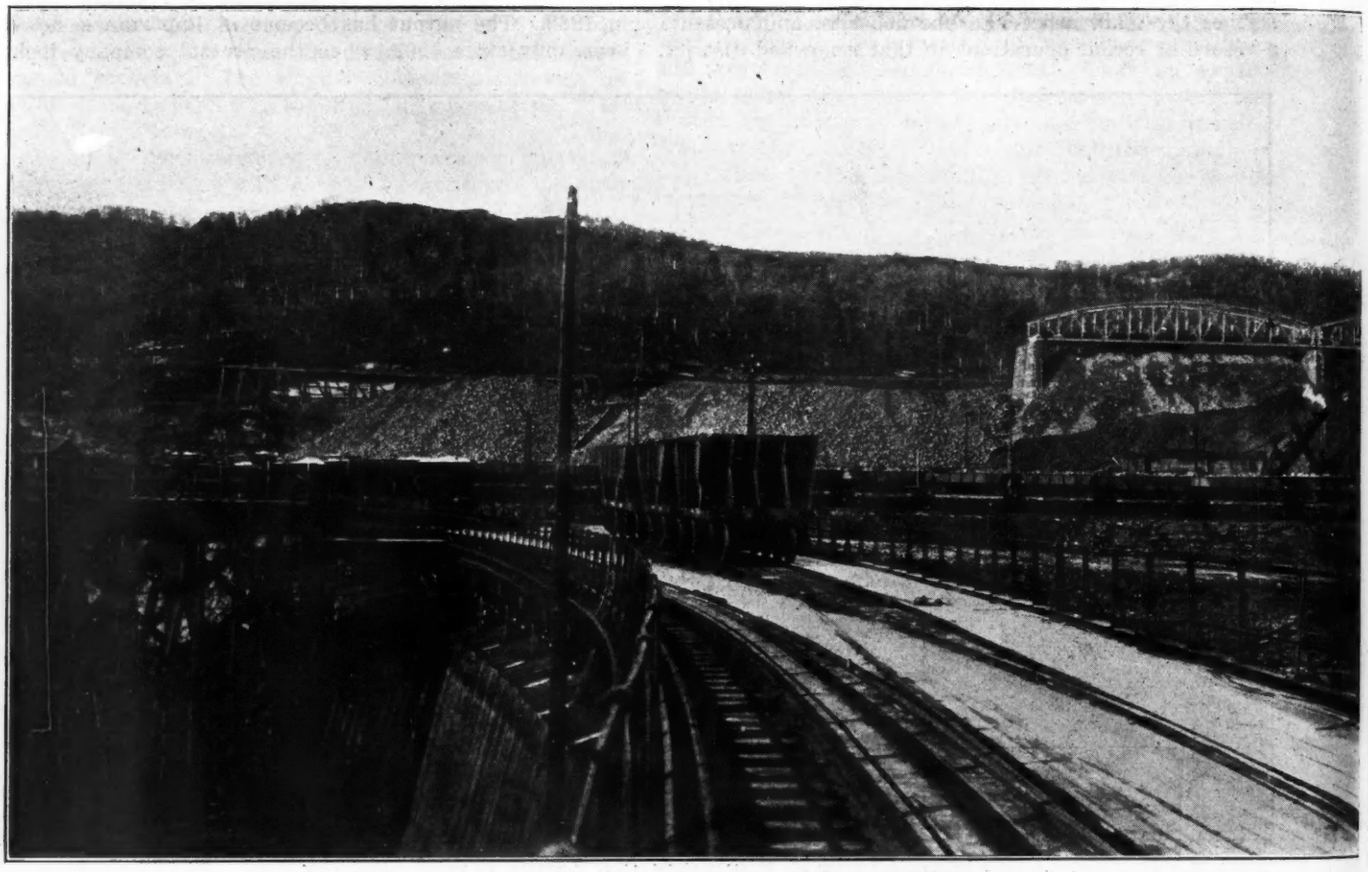
The annual output of the mines is limited by law to a maximum of 1,300,000 tons for Gellivare, and 5,000,000 tons for Kiruna. The statute was promulgated in 1907, and continues in force until 1932, unless previously repealed.

Gellivare is the older mine, having been worked first in 1869. The output has become of importance, however, only since 1902, when the present company took control. The total production is about 25,000,000 tons, practically all of which has gone to Germany. The ore is exported through the port of Luleä, which is 127 miles from the mine. The port is ice-bound for about six months, from the latter part of November to the latter part of May. The annual output before the war was the maximum permited by law, 1,300,000 tons, but since 1915 the production has been much below this figure.

The Gellivare ore occurs in a series of connected lenses inclosed in schists of igneous origin. The length of the zone is three miles, and the average width of the lenses is about 180 ft. The general trend of the orebody is east-west, and the average dip is S. 65 deg. The developed reserves are estimated at 250,000,000 tons, with a further considerable amount of ore remaining to be developed by deeper boring. The lenses are mined to an average depth of 150 ft. by open-cut methods, below which shrinkage stoping is employed. At present, 25 per cent of the output is obtained from open cuts, and 75 per cent from underground mining.

Of the total amount mined, 75 per cent is clean ore ready for shipment, 15 per cent is concentrating ore carrying 45 per cent Fe, and 10 per cent is waste.

The clean ore is divided into three classes, A, B and C, according to phosphorus content. The A grade carries from 0.8 to 1.0 per cent P and from 61 to 62 per cent Fe. C grade carries under 0.3 per cent P and contains 65 per cent Fe, and B is a grade intermediate between A and C. The concentrating ore is reduced to 2 mm. by crusher and ball and tube mills, and is concentrated by magnetic separators of the drum type. This process yields a concentrate carrying about 0.3 per cent P. To reduce further the phosphorus content of the concentrate, arrangements are being made for finer grinding. The concentrate is shipped direct, without briquetting, to Germany.



PANORAMA OF THE ORE DUMPS, NARVIK, NORWAY. THE

HIGH-PHOSPHORUS ORE SALABLE TO GERMANY

The dependence of the iron mines on Germany for the market of certain products brings out in sharp relief a phase of German pre-war industry which sometimes passes unnoticed. Not only did German manufacturers suit the finished product to the particular demand in the country of eventual market, but German industry accepted its raw materials in whatever form they could most conveniently be delivered by the producers. Thus the German steel industry readily purchased the high-phosphorus ores of Kiruna and Gellivare, which are undesired in other countries, and it furnished a good market for the unbriquetted iron concentrate, a product salable with difficulty elsewhere.

Kiruna lies 56 miles nearly due north of Gellivare, and 105 miles from the port of Narvik. Its deposits have been known for many years, but active work dates from the opening of the railway to Narvik, the shipping point, in 1902. Narvik is an ice-free port, where extensive docks and storage yards are maintained. It has an advantage over Luleä, the shipping point for Gellivare ores, in that it is open to navigation throughout the year, and is nearer to the markets of England and America.

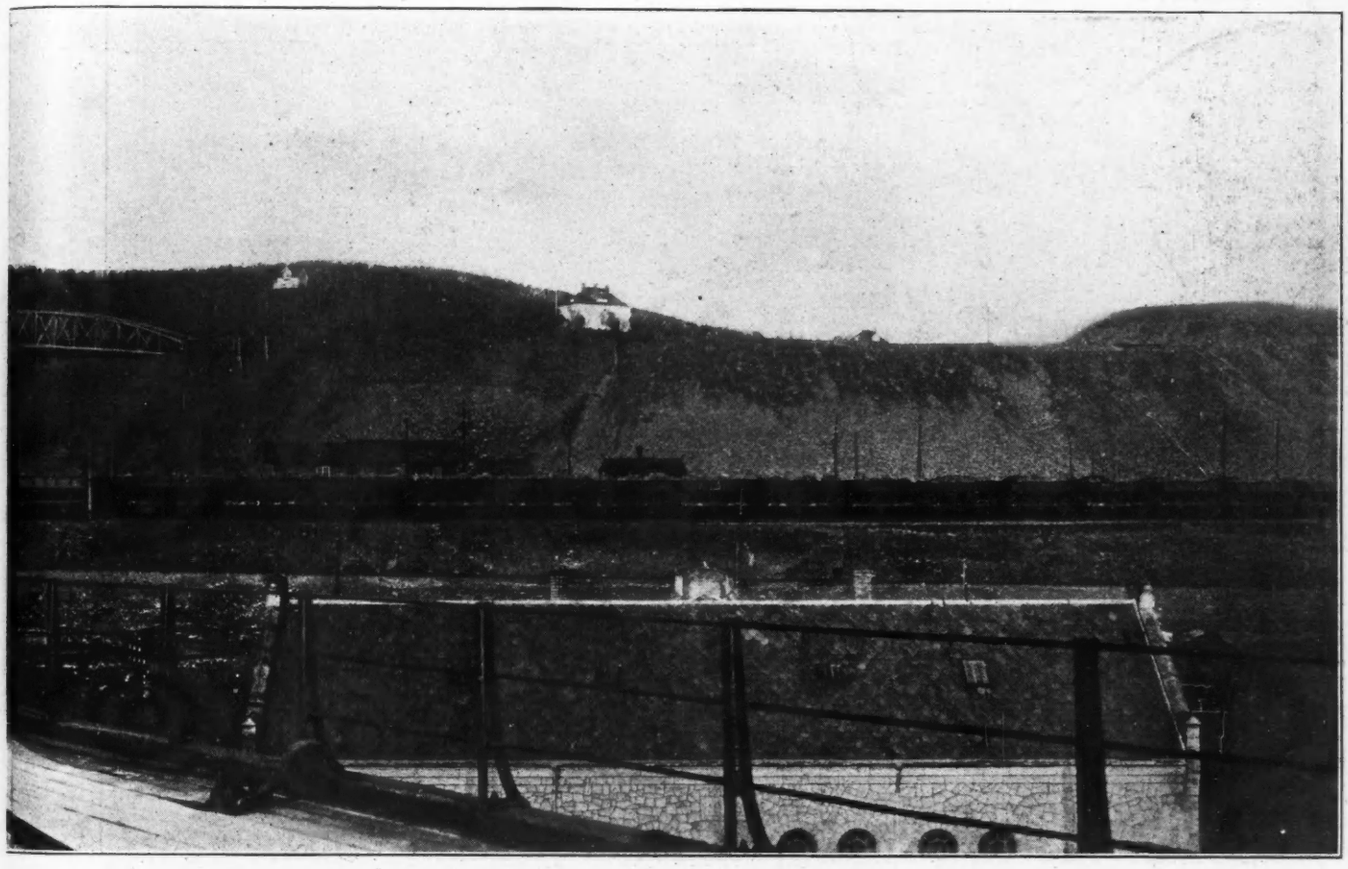
The Kiruna orebody outcrops in two large hills which rise prominently above the glacial plain making up this section of Lapland. The hills are separated by a small lake, on the north shore of which the railway station and town of Kiruna are located. The orebody trends in a general north-south direction. The main outcrop occurs in the southernmost hill, which rises to an elevation of 800 ft. above the lake. To the north, the deposit passes under the lake and outcrops again prominently in the second hill, about 600 ft. high, which lies northwest of the town.

The orebody is a dike-like mass of magnetite, with small amounts of apatite, about three miles long, and averaging 300 ft. in width. The deposit dips 55 to 60 deg. E. between a foot wall of syenite porphyry and a hanging wall of quartz porphyry. The consensus of recent geological opinion is that the orebody is a true igneous dike.

The deposit has been exhaustively surveyed by dip needle, observations being taken at the corners of 10-metre squares over a large area. Development has been by diamond drilling. The deepest hole penetrated

the orebody at 2,600 ft. below the level of the lake (or 1,000 ft. below sea level), and 3,400 ft. below the highest outcrop. The deposit maintains a uniform width in depth, and is reported to be appreciably freer from apatite, and consequently less in phosphorus content, in the lower levels.

The developed ore is estimated at 750,000,000 tons, but this by no means exhausts the possibilities of the deposit. Mining is carried on exclusively by open-cut methods. Operations are confined to the north slope of the main hill (called "Kiirunavaara," or Kiruna Mountain), just south of the lake and in full view from the railway station. At present, there are twelve benches of 66 ft. each. Drilling is done with hand machines using compressed air.



STRUCTURE IN THE LEFT FOREGROUND IS PART OF THE ORE DOCKS

The ore, after blasting, is loaded into eight-ton cars by electric shovels. The main working level is 400 ft. above the lake. The loaded cars are brought to this level and dumped into vertical shafts leading to a tunnel at the lake level. The tunnel is provided with ore pockets, from which standard-gage railway cars of thirty-five ton capacity are loaded. The ore is divided, as mined, into four grades based on phosphorus content, a shaft being provided for each class. The highest grade ore carries less than 0.04 per cent P, and 68 per cent Fe; the lowest contains over 2.5 per cent P and is somewhat lower in iron.

About 15 per cent of the ore now mined is of the first grade, the remainder being about equally divided among the other classes noted.

The amount of stripping required in cutting away the hanging wall and trimming back the foot wall is comparatively small. It is estimated that, for the entire orebody above the lake level, only 35 tons of waste must be removed for every 100 tons of ore.

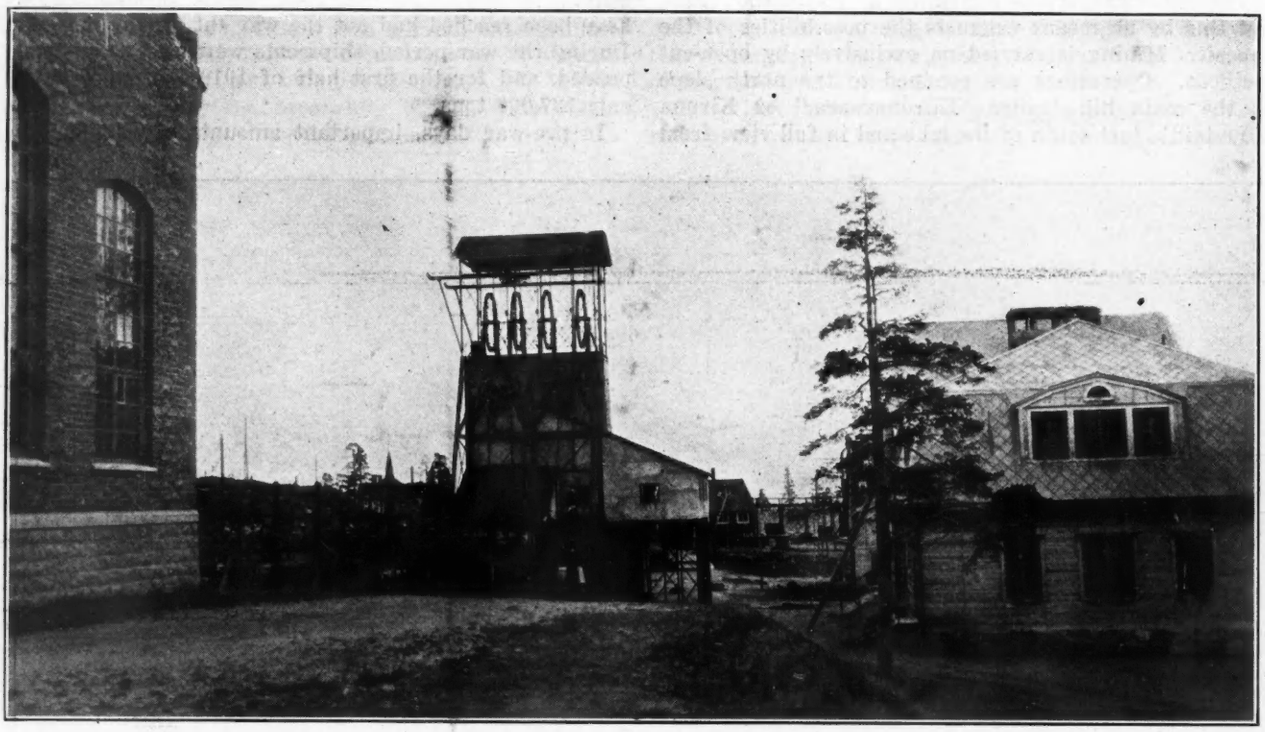
The first shipment of Kiruna ore was made from Narvik in January, 1913. By 1913 the output reached 3,100,000 tons, and the maximum annual output permitted by law, 5,000,000 tons, would probably soon have been reached had not the war cut off the market. During the war period, shipments were practically suspended, and for the first half of 1919 the export was only 137,000 tons.

In pre-war days, important amounts of Kiruna ore were sent to England and America, though the major portion of the production was shipped to Germany. The high-phosphorus ores found an especially favorable market in Germany, where basic converters yielded a slag which was valuable as a source of phosphorus for fertilizers.

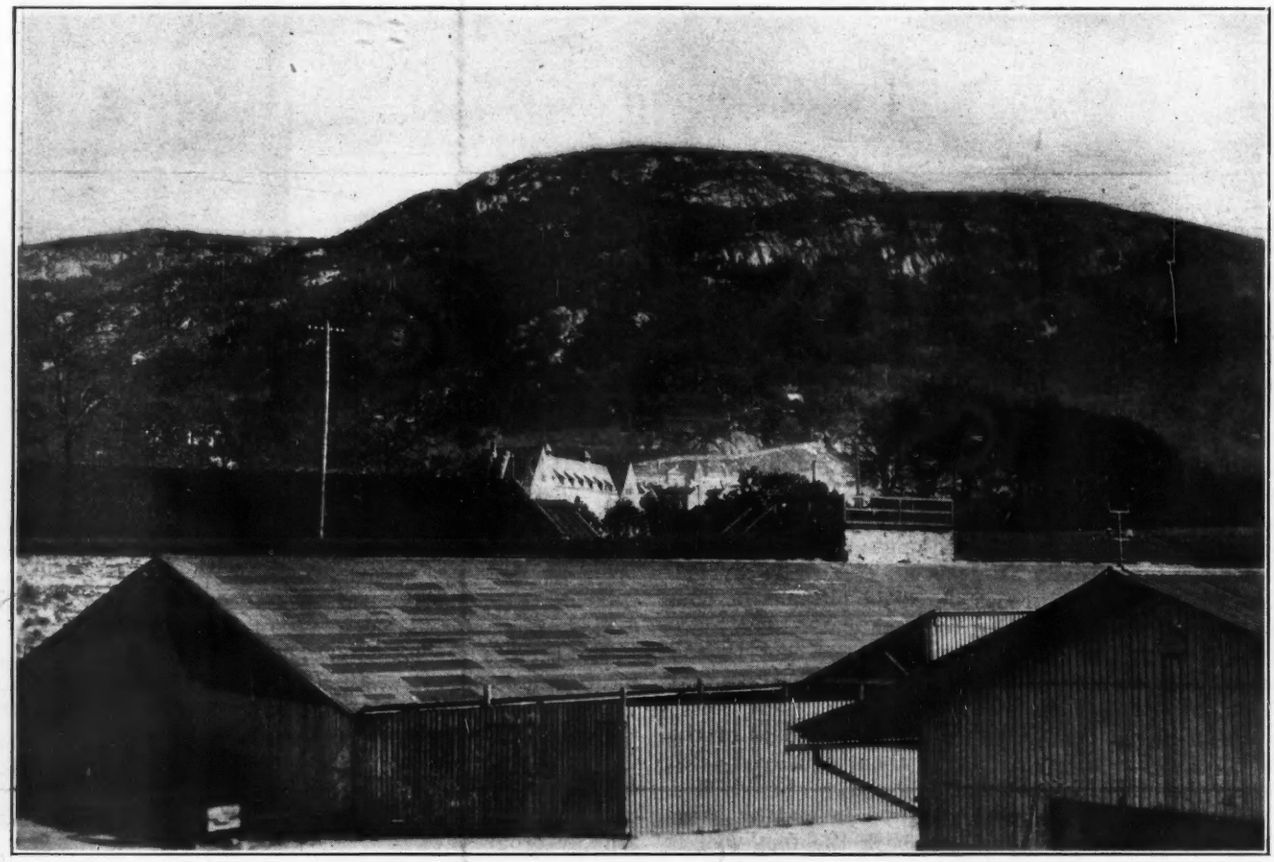
Kiruna ranks as one of the most northern mining industries of the world, the latitude being N. 67° 50′. In spite of its situation well within the Arctic Zone, open-cut methods are employed, with comparatively little decrease in efficiency under conditions that exist during the winter period.

The aspects of the Gellivare and Kiruna mines which most impressed me are: The tremendous reserves, in excess of a billion tons; the richness of the ores; the comparatively favorable mining and marketing conditions, despite location well within the Arctic Circle, and the efficiency of the management, which is thoroughly technical and operates under a policy that is soundly progressive.

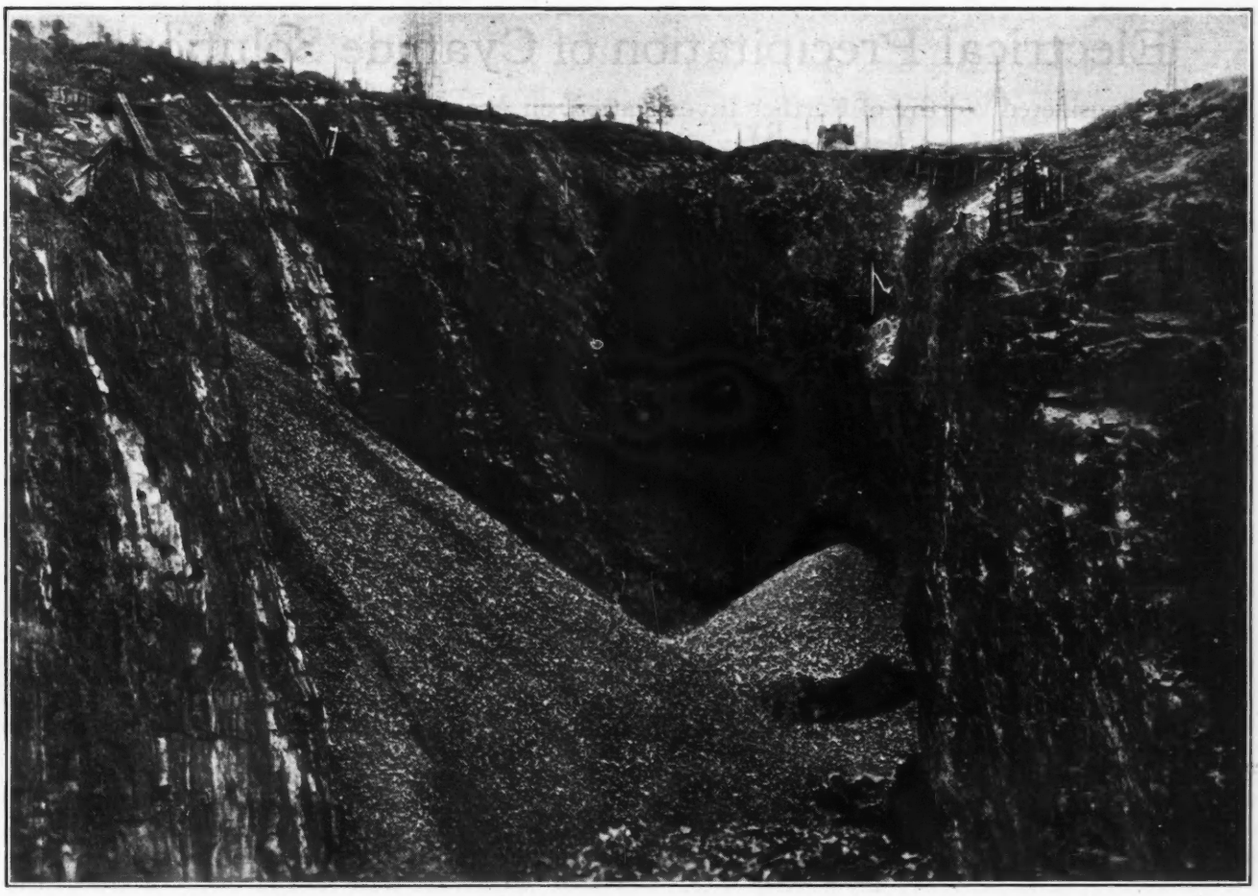
Photographs From Swedish Iron Mines



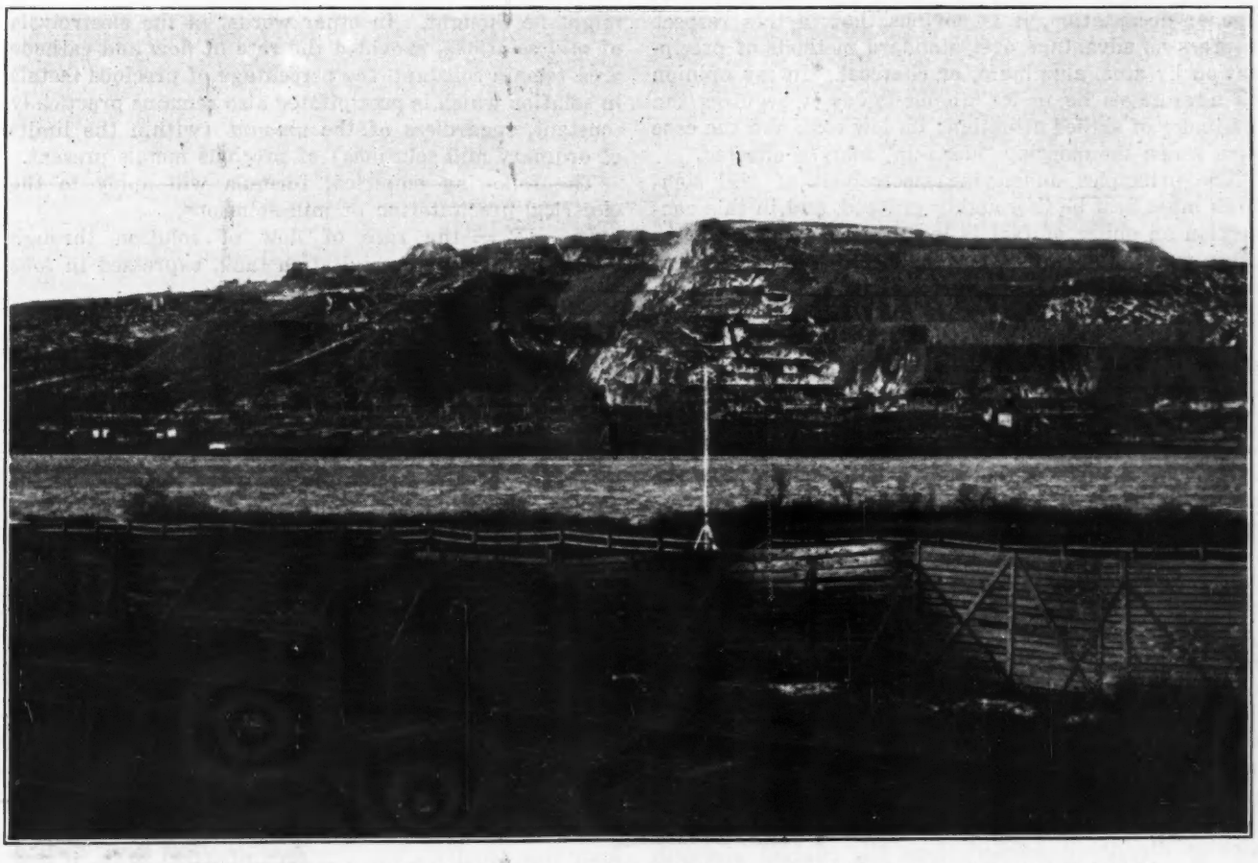
THE CAPTEN SHAFT AT GELLIVARE. THIS IS THE OLDEST MINE IN THE DISTRICT



THE MINES AT GELLIVARE FOLLOW THE RIDGE OF THE MOUNTAINS IN THE BACKGROUND



OPEN CUT AT THE CAPTEN MINE. ORE IS MILLED AND HOISTED BY SHAFT



THE KIRUNA MINE AS SEEN FROM THE RAILROAD STATION. THE OREBODY CROSSES THE SMALL LAKE IN THE FOREGROUND

Electrical Precipitation of Cyanide Solutions

Process Considered Worthy of Further Investigation, on Account of Its Simplicity and Cheapness—Lead Cathodes May Be Shipped as Base Bullion, or Paper Cathodes Used—Solutions Must Be Clear

BY DOUGLAS LAY

Written for *Engineering and Mining Journal*

THE conclusions expressed herein are based upon the results obtained from actual mill runs and "clean-ups" with electrical precipitation. They represent a somewhat exhaustive investigation of the process in its application to both unclarified and clarified solutions.

Such commercial success as has attended electrical precipitation has been in the use of the method with clarified solutions only. Attempts simultaneously to dissolve and precipitate muddy solutions during agitation, generally introduced to the mining public as "electro-cyanide" processes, have been numerous, but have not shown much evidence of commercial possibilities. In fact, many extravagant statements have been made concerning this type of precipitation, which have been followed by failures in practice. This appears to have had the effect of discrediting electrical precipitation generally, and so discouraging investigation. At any rate, electrical precipitation rather seems to lie under a cloud of suspicion, and it is generally taken for granted that it has been tried in the balance and found wanting.

As successful electrical precipitation necessitates preliminary clarification of mill solutions, either by filtration or decantation, it is obvious that in this respect it offers no advantage over standard methods of precipitation by zinc, aluminum, or charcoal. In my opinion its advantages lie in its simplicity, as it requires the minimum of skilled attention; its low cost, and the ease with which the monthly "clean-up" may be effected.

The principles underlying electrolysis of mill solutions must first be thoroughly grasped, and in this connection an ounce of fact is worth a ton of theory, because mere study of the laws of electrolysis is likely to lead to erroneous conclusions as to what may happen in the treatment of mill solutions.

Cyanide solutions constitute an extremely dilute electrolyte, as they are weak and contain a very small percentage of precious metals to be deposited. Consequently, much of the energy of the current is wasted in decomposing the water, resulting in the generation of oxygen at the anodes and hydrogen at the cathodes. As mill solutions are not electrolytes, within the textbook meaning of the word, a common mistake arises from the erroneous impression that the rate of precipitation of precious metals can be readily controlled, within wide limits, by varying the current strength. Accordingly, if it is found that a precipitation tank is not robbing the solution adequately of its precious-metal contents, the current density is frequently increased, in the largely futile expectation that precipitation will thereby be rendered more complete, whereas, for reasons subsequently given, only a weak current is necessary or permissible.

It must be borne in mind that the rate of precipitation is directly dependent upon the current strength only when the latter finds abundant metal to deposit and when the percentage of metal is kept constant in the electrolyte. Such would be the condition were soluble anodes employed that were of the same composition as the metal deposited, as in lead and copper refining; or were constant additions of the metal deposited being made to the electrolyte, if insoluble anodes were used. In the electrolysis of *mill solutions*, different conditions from those last described prevail, and for all practical purposes the percentage of the precious-metal contents of the mill solution which is precipitated depends upon the rate of flow of the solution through the tank, and also upon the cathode area, and not upon the current strength or the amount of precious metals present in the solution. The rich solution from the purely milling point of view is extremely poor from the electrolytic standpoint.

To illustrate a concrete case: Suppose a solution assaying $2 per ton in gold is passed through a precipitation tank at such a rate that the tailing solution assays $1 per ton in gold. If this tailing solution is again passed through the same tank at the same rate as before, the tailing solution from the second operation will still assay 50c. per ton in gold, and not zero, as at first might be thought. In other words, in the electrolysis of *mill solutions*, provided the rate of flow and cathode area remain constant, the percentage of precious metals in solution which is precipitated also remains practically constant, regardless of the *amount* (within the limits of ordinary mill solutions) of precious metals present.

The following empirical formula will apply to the electrical precipitation of mill solutions.

If R = the rate of flow of solution through the precipitation tank, expressed in *tons per hour*,

and K = the cathode area necessary to secure complete precipitation of precious metals, expressed in *square feet;*

then $K = 1750 \times R$.

By "complete precipitation" is meant a tailing solution such that when ten assay tons of it are taken, only a "trace," or a few cents per ton, are returned by the assayer.

The above equation will hold provided that: (1) The electrodes are connected up in multiple; (2) The anode and cathode areas are equal. (The effective area of deposition on a cathode is equal only to that of the anode opposite; consequently, no useful purpose is gained by having a cathode larger than the corresponding anode.) (3) The distance between anodes and cathodes is 1½ in. This distance will be found in practice the most convenient spacing for anodes and cathodes.

By means of this formula, the necessary cathode area to cope with any given flow of mill solutions can be calculated readily. For instance, a flow of two tons per hour will require a cathode area of 3,500 sq.ft., if pre-

cipitation is to be approximately complete. Deposition takes place on both sides of the cathode; consequently, in the formula, "*K*" signifies the sums of the areas of both sides of the cathodes. The cathode area being known, and also the spacing between anodes and cathodes, it is manifest that a simple calculation will determine the size of the tank required.

If, then, any given tank fails adequately to precipitate the precious metals, the remedy is either to decrease the rate of flow or to increase the cathode area, and not to increase the current density.

It is perhaps superfluous to say that the strength of the cyanide solution, in terms of free cyanide, has no bearing upon electrical precipitation, except as it affects the electrical resistance of the circuit. The stronger the solution, the less the resistance, and the greater the amperage with any given voltage.

Reasons for Using Only a Weak Current

As has been demonstrated, in the treatment of mill solutions, to all practical intents and purposes the percentage of precious metals deposited is independent of the strength of the electric current employed. Certain factors are, however, essential to the success of the process, which are directly dependent upon, and entirely governed by, the current strength. Careful attention must be given to them, for they constitute the reasons that only a weak current can be employed successfully. These factors are:

1. *Wear of Anodes*—The electrolyte being extremely dilute, decomposition of the water takes place. The generation of oxygen at the anodes results in the oxidation and wearing away of the latter, if they be metallic, or in disintegration, if they be non-metallic. The wearing process is slow or rapid, according as the current is weak or strong. This wear of anodes constitutes the only appreciable item in the cost of electrical precipitation, and, as it is directly dependent upon the current density, this is one good reason why only a weak current must be used.

2. *Precipitation of Calcium Carbonate on the Cathodes*—This is inseparable from electrolytic action, as lime almost certainly will be used to neutralize the acidity present in the ore. The hydrogen generated at the cathodes, in the presence of calcium hydrate and free cyanide, causes a precipitate of calcium carbonate on the cathodes, the carbon atom being taken from the cyanide. With a low current density of from 0.02 to 0.04 amperes per sq.ft. of cathode surface, the receptive quality of the cathodes, so far as the precious metals are concerned, is not impaired. Conversely, a high current density causes a heavy precipitation of calcium carbonate, closely resembling boiler scale, stopping precipitation of precious metals almost completely.

3. *Nature of Deposited Metal*—It is of the utmost importance that the precipitated metals should adhere firmly to the cathodes, and that there should be no chance of the deposit being rubbed off. The voltage must not fall below three volts, or black oxides of the precious metals may be deposited. These black oxides form a soot-like deposit, which is easily rubbed off.

For the foregoing reasons, a current density of 0.02 to 0.04 amperes per sq.ft. of cathode surface should be used, and the voltage should not fall below three or rise above five.

The commercial success of electrical precipitation undoubtedly depends in large measure upon the selection of the best material for the cathodes and anodes, more especially for the cathodes.

Obviously, base metal or carbon anodes must be employed. Only three substances, practically speaking, are suitable for the purpose: carbon, sheet iron, and lead. Of these, carbon or graphite anodes are not satisfactory, as they are somewhat fragile and cannot be procured of reasonable thickness and at the same time exposing sufficient surface area. Sheet-iron anodes have been generally used because of their cheapness, and also for the reason that they are suitable for making water-tight compartments.

It is generally good practice to baffle the flow of solution through the precipitation tank, by letting alternate anodes extend to the bottom of the tank from a point, say, one inch below the surface of the liquid. Alternate anodes again extend from a point about one inch above the level of the liquid to a point about two inches above the bottom of the tank, so that the flow is over the top of one anode and under the bottom of the next. With this arrangement, alternate anodes together form a practically water-tight compartment. Anodes are sometimes covered with cheesecloth to prevent accidental short-circuiting, but this is not strictly necessary, as, because of the weak current used, no danger can result therefrom. A short-circuit immediately stops electrolytic action, and can therefore readily be detected and remedied.

It must be bore in mind that anodes and anode connections below the level of the liquid are oxidized and gradually worn away by the action of the current. In the use of iron anodes, the anode oxidation product may be either mainly ferric hydrate or prussian blue. I have found that by keeping the protective alkalinity at about 0.03 per cent CaO, the anode product consisted almost entirely of ferric hydrate. This is desirable, because ferric hydrate floats and is readily disposed of in a manner to be described subsequently; whereas, prussian blue is heavy, and sinks to the bottom of the anode compartments. Aside from impeding the flow of solution, any accumulation of anode product is undesirable in the precipitation tanks, because it invariably contains high precious-metal values. These are loosely held and rapidly pass into solution again in the sump tank.

Metal From Oxidation of Lead Anodes May Be Recovered

Iron, once oxidized, is no longer available, and it is manifest that if iron anodes are used, their depreciation, although not a heavy item, must nevertheless be written off as a direct charge against the cost of electrical precipitation. Not so with lead. A lead oxidation product can be readily converted into lead again, at comparatively small cost. Or, if so desired, the lead anode product could be sold as such to any smelter. Whichever expedient be adopted, the cost of precipitation would receive credit. Although my experience has been confined mainly to the use of sheet-iron anodes, trial of lead anodes has convinced me of their great possibilities. Nevertheless, the thorough baffling of the flow of solution through the precipitation tanks, before described, and which I adopted, could hardly be made as effectual with lead as with iron anodes. However, this could be offset readily by increasing the cathode area. It must not be understood that the use of iron anodes is detrimental to the high efficiency and low cost of electrical precipitation; I merely wish to point out that lead

anodes merit further investigation. It is possible that their use might have a beneficial action on the cyanide solutions, in increasing their solvent action upon the precious metals contained in the ore.

NATURE OF CATHODE IS IMPORTANT

The deposit must be made upon a cathode of such nature that the precious metals can be easily recovered from it. One of the reasons that electrical precipitation has not been more widely adopted is the difficulty of recovering the precious metals from the cathodes, after precipitation. Many expedients have been tried in the attempt to overcome this, among them amalgamated plates. These were unsuitable, because the amalgam, under the influence of the current, became extremely hard and brittle. Another expedient was to coat a metallic surface with graphite, so that the deposit of metal would not adhere firmly and could be scraped off for the purpose of a "clean-up." The last named operation involved too much labor to be practicable.

So far, lead is the only substance which has proved a commercial success as a cathode. In South Africa, where electrical precipitation was first tried, very thin lead sheets were used, and recovery of the precious metals was effected by cupellation, which added greatly to the cost. I once adopted the simple expedient of shipping the lead cathodes as base bullion to a custom refinery after a month's run.

The total cost of the month's "clean-up" was about $45, and 100 per cent of the gold contents was paid for. As custom refineries are fairly plentiful in America, this practice should be satisfactory for most mines, except those in remote districts. Such a "clean-up" is cheap, involves no trouble, and solves the vexed question of the recovery of the deposited precious metal from the cathodes. Incidentally, there is no danger of theft of bullion.

Lead sheets, whether for anodes or cathodes, can be readily and cheaply made at the mill, by Miller's process, which is fairly well known. The apparatus is simple, and consists of a trough at the head of an inclined slab of cast iron. Molten lead is poured into the trough, which is suddenly tipped up, causing the lead to flow down over the inclined slab of cast iron. Solidification takes place immediately, and the result is a sheet of lead, the thickness of which can be varied by varying the angle of inclination of the cast-iron slab.

Great care should be taken that the surface of the cathodes is clean and free from oxide before immersion in the precipitation tanks. They may be dipped in a solution of zinc chloride, rinsed in water, and then immediately immersed in the precipitation tanks. After immersion in zinc chloride, it is most important that the sheets should not be allowed to dry, and thus to oxidize before being placed in the precipitation tanks.

As has been mentioned previously, the precipitation of calcium carbonate on the cathodes, along with the precious metals, is inevitable. If the weak current specified is employed, the receptive qualities of the cathode will not be impaired for a period of at least thirty days. After this time there is a perceptible roughening of the surface of the cathodes, due to calcium carbonate, and it is advisable to replace them with new sheets.

I obtained most promising results from the use of paper cathodes, which gave high promise of solving the difficulty connected with recovery of precious metals from cathodes. Unfortunately, other matters engaged my attention before a conclusive test was possible, and the opportunity of further investigation has not presented itself. However, such information as I have had is given in the hope that it will be of service to others.

By employing a substance such as paper for a cathode, when the precious metals have been deposited, simple incineration and melting will result in a high-grade bullion, without the intervention of a refining process. Any reasonably stout paper of smooth surface, such as the cover of the *Engineering and Mining Journal*, serves well. It is cut into strips of the desired size, and waterproofed by momentary immersion in melted beeswax. Before the wax has solidified, the paper is dipped into Dixon's coarse flake graphite, and the latter is well rubbed in until the entire surface of the paper is covered with a uniform coating of graphite, which is, of course, a conductor of electricity. If this cathode is now placed in the precipitation tank, and suitably connected to the cathode cross-bar, it will receive a deposit of precious metal, just as though it were wholly metallic.

The following simple method of connection answered well: A small piece of copper foil about 1 in. square was doubled in half and clamped to the centre of the top of the cathode strip by an ordinary tie clip. The latter was soldered to a piece of copper wire, the other end of which was bent to form a hook, by means of which the cathode was suspended from the cross-bar. Such a cathode appeared to receive a deposit just as readily as a metallic lead cathode, and after a day or so became similar to a metallic strip in physical properties.

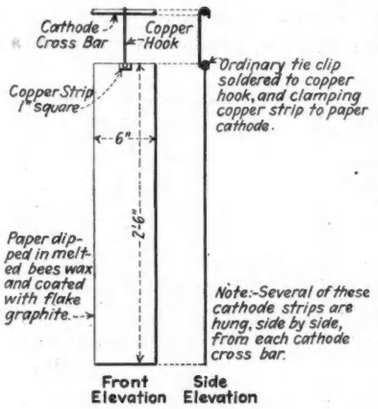

Cathode Cross Bar
Copper Hook
Ordinary tie clip soldered to copper hook, and clamping copper strip to paper cathode.
Copper Strip 1" square
6"
2'-6"
Paper dipped in melted bees wax and coated with flake graphite.
Note:-Several of these cathode strips are hung, side by side, from each cathode cross bar.
Front Elevation
Side Elevation

FIG. 1. DETAILS OF PAPER CATHODE

The investigation which I conducted consisted of suspending these paper cathodes at various points in a precipitation tank treating mill solutions, but in which the cathodes consisted mainly of sheet lead. Promising as were the results obtained with paper cathodes, I cannot give the results of an actual month's "clean-up," and further trial is of course necessary. They do, however, unquestionably merit investigation, and seem likely to solve what has been a somewhat knotty problem in connection with electrical precipitation.

Unless the solution contain sufficient protective alkali, there seems to be appreciable loss of free cyanide in passage through precipitation tanks. Solutions containing a trace of protective alkali, passed at the rate of two tons per hour through a tank containing 3,500 sq.ft. of cathode surface, were found to lose about 30 per cent of their free cyanide; but solutions containing a protective alkalinity of 0.03 per cent CaO disclosed no appreciable loss of free cyanide. A loss of protective alkalinity in course of passage through precipitation tanks must always occur, owing to the action of the current in precipitating calcium carbonate on the cathodes, as has been described. The regeneration of cyan-

ide caused by splitting up double cyanides prior to precipitation counterbalances the loss of cyanide caused by precipitation of calcium carbonate.

Advantages of Electrical Precipitation

Attractive features are:

1. The small amount of skilled attention required.

2. The ease and cheapness with which a "clean-up" can be effected. No stoppage of operations is entailed. Cathodes may be removed at any time and replaced by new sheets, without switching off the current. Granted

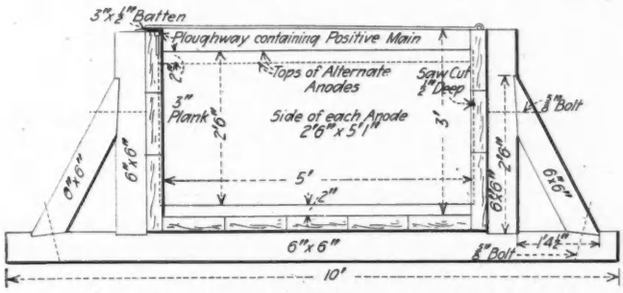


FIG. 2. CROSS-SECTION OF PRECIPITATION TANK SHOWING ANODES

that the efficiency and commercial success of such a cathode as that made of paper have not been thoroughly proved, the expedient of employing lead sheets, made by Miller's process, for cathodes, and shipping these once a month as base bullion, is an inexpensive way of making the "clean-up," and appears thoroughly sound commercially.

3. The consumption of electrical energy is very low, in fact little more than nominal. For each ton of mill solution to be precipitated per hour, 1,750 sq.ft. of cathode surface is required. With a current density of, say, 0.03 amperes per sq.ft., and a voltage of, say, 5, approximately three-eighths of one electrical horsepower will be sufficient.

The only appreciable item in the cost of the process is the wear of the anodes. Even in using iron anodes, this is not formidable. If lead anodes are used, the anode oxidation product can be readily re-converted into lead, or sold as such without reduction. This would reduce the cost of the process to a small amount.

Precipitation Tanks Handled Two Tons Per Hour

The tank which I designed and used is illustrated in the accompanying sketches. Its dimensions were 35 ft. long by 5 ft. wide by 3 ft. high. It contained 3,500 sq.ft. of cathode surface, as it was designed to precipitate mill solution flowing through it at the rate of two tons per hour. Anodes were of sheet iron approximately $\frac{1}{8}$ in. thick, and were fitted into saw cuts in the sides of the tank. Every other anode extended to the bottom of the tank, the top of one anode being below the solution surface level, and the next anode to it raised 2 in. above the bottom of the tank, so that its top projected above the surface of the solution. With this arrangement the solution flowed under the bottom of one anode and over the top of the next. The distance between anodes was 3 in., and the size of each anode was 2 ft. 6 in. by 5 ft. 1 in.

The positive electric main was laid in a ploughway extending along the top of one side of the tank. Electrical connection with each anode was established through a $\frac{1}{4}$-in. hole bored vertically downward from the bottom of the ploughway to the top corner of the anode. Therefore, no anode connections were submerged and so exposed to wear. A wooden batten tacked down on top of the side of the tank covered the positive wire.

Cathodes were of sheet lead, about $\frac{1}{16}$ in. thick, and were of approximately the same size as the anodes, but, for convenience in handling, were divided into three strips. They were suspended from the cathode crossbar by copper hooks. The distance between anode and cathode was $1\frac{1}{2}$ in. Cathode cross-bars were of $\frac{1}{4}$-in. round common iron. One end was swaged to a semicircle, to engage the No. 1 gage circular $\frac{1}{4}$-in. copper negative main which was tacked on the top of the side of the tank. Paper cathodes, as mentioned, were tried in this tank, under the same conditions as the lead cathodes.

Long Tank Assures Thorough Ionization

The purpose of having a tank of great length in relation to its width is to secure as thorough ionization of solution as possible. In normal working, evidence of electrolytic action shown by evolution of oxygen at the anodes, and of hydrogen at the cathodes, is most marked at the outlet end and least noticeable at the inlet end, the reason being that as ionization becomes more complete, electric resistance is diminished and more current automatically flows.

The normal outlet for solution is by a pipe at the outlet end of the tank placed at the level of the submerged anodes. By closing the valve on this pipe, the level of the solution is raised to the level of the outlet lip of the tank, which is placed just above the level of the anodes which project above the surface of the solution in normal working. This operation causes any floating anode product to be floated off to the sump tank. The operation, which occupies only two or three minutes, was performed once a day.

The mill solutions treated averaged $2 per ton in total precious-metal values before precipitation (the weight of gold and silver per ton being about equal). After precipitation, tailing solutions assayed from a "trace" to a few cents in total per ton, the precipitation being as nearly as possible complete.

So-called electro-cyanide processes differ in details of design and equipment, but all have the same underly-

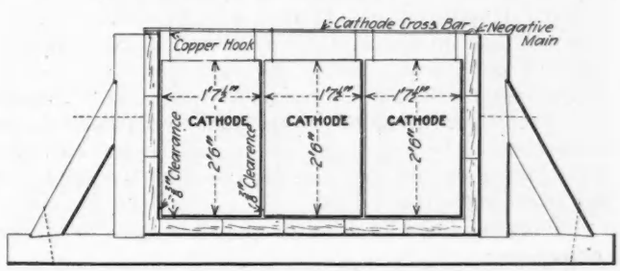


FIG. 3. CROSS-SECTION OF PRECIPITATION TANK SHOWING CATHODES

ing feature, viz., precipitation during agitation of finely ground ore and solution in a pan or agitator. An attempt is thus made simultaneously to dissolve the precious metals from the ore, and to precipitate them.

A twofold claim is generally made: (1) That precipitation is complete, or nearly so, during the period of agitation. (2) That the electric current exerts a beneficial action in aiding the dissolving of the precious

metals present in the ore. Exhaustive trials have convinced me of the impossibility of substantiating these claims, for the following reasons:

1. *Percentage of precious metals precipitated.*

Assume that an agitator, or pan, holds twenty tons of pulp and thirty tons of cyanide solution, and that the period of agitation is eight hours. To secure complete precipitation in this time, a cathode area of 30 × ⅛ × 1,750, or 6,563 sq.ft., would be required. In the agitator specified it will not be practicable to suspend more than 650 sq.ft. of cathode surface, or, at most, 1,000 sq.ft. If a smaller agitator be assumed, the cathode area will be still further reduced. It follows that that proportion of the total precious metals present in solution which will be precipitated will be represented by the fraction 650/6,563, or, say, one-tenth. In fact, in my experience, the tailing solution after agitation frequently assayed more in precious metals than the feed solution, owing to solution taking place more rapidly than precipitation.

2. *Possible beneficial action exerted by electric current in aiding in the dissolving of precious metals.*

Any beneficial action must result either from generation of oxygen at the anodes, from regeneration of free cyanide caused by the splitting up of double cyanides resulting from electrolytic action, or from the simultaneous influence of both. It already has been demonstrated that only a weak current is practicable; consequently, generation of oxygen cannot be active, and therefore too much emphasis must not be laid on this factor. Again, it has been shown that only a small percentage of the precious metals present in solution can be precipitated; consequently only a small percentage of the double cyanides can be decomposed. Further, any liberation of free cyanide is counterbalanced by that destroyed by the reaction which results in the precipitation of calcium carbonate on the cathodes.

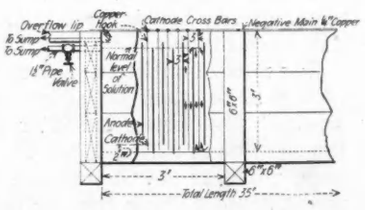


FIG. 4. SIDE ELEVATION OF PRECIPITATION TANK, OUTLET END

Frequently, the addition of salt is specified during agitation. The effect of this is of course to reduce the electric resistance, and to increase the current. Adding salt has no material effect, as has been previously pointed out, in increasing the percentage of precious metals deposited, and serves merely to cause an undue and prohibitive wear of anodes, and to deposit calcium carbonate so heavily upon the surface of the cathodes that their receptive qualities for the precious metals are seriously impaired.

Precipitation in an agitator or pan is open to serious objections:

1. The surface of the cathodes must be kept free from oxide; a surface once so prepared must not be allowed to dry. However little time is occupied in discharging and recharging an agitator or pan, the surface of the cathodes will dry and oxidize to some extent, and the receptive quality will be correspondingly impaired. The drying of any slime on a cathode might effectually insulate a part of it.

2. Anode connections below the surface of the solution are gradually eaten away by the action of the current. Precipitation in an agitator necessitates complete submergence of anode connections and renders their insulation difficult.

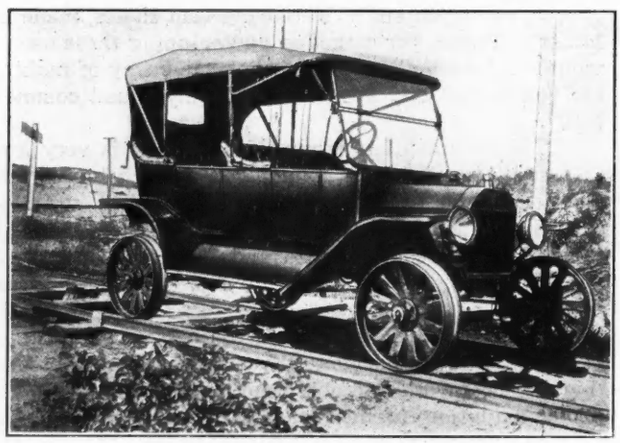
3. Inasmuch as there must be at some stage in the cycle of the cyanide process a separation of solid from liquid matter (otherwise there is prohibitive loss of cyanide), no justification would appear to exist for attempting to precipitate until this separation has been accomplished.

I have tried repeatedly most of the expedients usually adopted but failed to find evidence of the likelihood of the practical commercial success of precipitation during agitation.

Automobiling by Rail

Written for *Engineering and Mining Journal*

Many mining communities have good rail connections but poor automobile roads. In such cases quick transportation over short distances for from one to five persons can be obtained by mounting an automobile on trucks with flanged wheels suitable for running on a railroad track, as shown in the accompanying illustration. The car is more comfortable than the ordinary motor-driven "hand-car," and can be put back on rubber tires for ordinary use at any time. Such equipment is used on the Amador Central, in California, where, in going from the mines on the Mother Lode at Jackson and



EQUIPPED FOR RAILROAD TRAVEL

Sutter Creek to the main line at Galt, the traveler starts his railroad journey at Martel in a flivver with flanged wheels, which carries him over the first twelve- or fourteen-mile stretch. The International Nickel Co. also uses a car of this type on the Algoma Eastern Ry. to carry passengers from its Creighton mine to the O'Donnell roast yard; and over a private rail line from the Canadian Pacific Ry. at Turbine to the hydro-electric plant at High Falls. The photograph shows the car used on the latter line.

Asbestos Can Be Fine Spun

The earliest industrial application of asbestos was for spinning and weaving, to make non-combustible thread, yarn, rope, and cloth, and this has continued to be the most important use of asbestos ever since the days of the Greeks and Romans. Only the best grades can be used for this purpose, according to J. S. Diller, of the U. S. Geological Survey. Thread can now be spun so fine that the fiber will run about 32,000 ft. to the pound.

Unwatering by Air Lift in Grass Valley, California

Idaho-Maryland Property Has Now Been Successfully Opened Up to the 1,000-ft. Level By Air Lifts and Pumps—Details of Installing Lift Pipes in Old Shaft And Practical Operating Suggestions

BY GEORGE J. YOUNG
Written for *Engineering and Mining Journal*

THE old Idaho-Maryland mine, slightly over a mile east of Grass Valley, Cal., inactive since 1914, is being reopened by the Idaho-Maryland Mines Co. As a preliminary to mining, the old workings are being unwatered, and the surface plant is being reconstructed and put in first-class condition. Practically all of the old buildings have been torn down, a new compressor building and shops have been constructed, and a permanent wooden headframe and hoist are being installed.

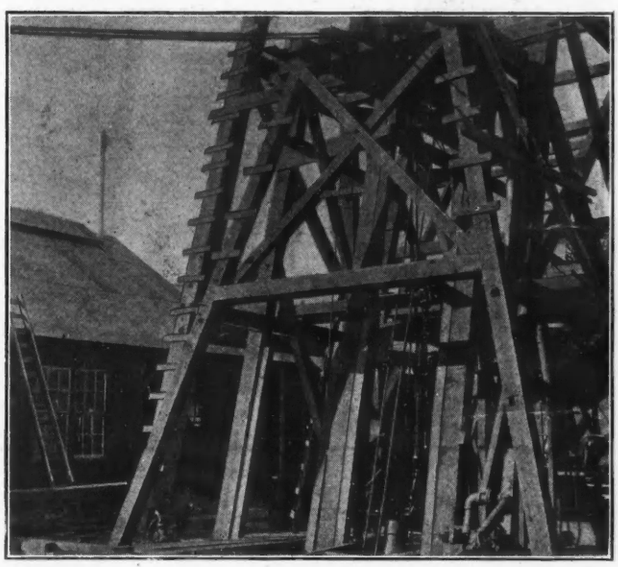


FIG. 1. TEMPORARY HEADFRAME AND SHAFT COLLAR

Two belt-driven, two-stage compressors with a combined capacity of 2,200 cu.ft. of free air per min. are in operation. The compressed air is being used for removing the water from the mine and for the operation of the temporary hoists.

Unwatering is being effected by an air lift. The capacity of the air lift averages about 900 gal. per min., but it has attained 1,400 as a maximum. The water is discharged through a drainage adit 23 ft. vertically below the collar of the shaft. The air lift, consisting of 10-in. oil-well casings, is installed in one of the hoisting compartments. A bronze foot-piece on the end of a 4-in. standard compressed-air pipe line is held in a central position in the 10-in. casing by suitable cages and lowered as the water in the mine is removed, so that proper submergence may be maintained. While the main air lift was being installed the shaft was unwatered to 208 ft. by dropping a 4-in. pipe down the old Cornish pump column, a distance of 300 ft. and drawing the water up through the pump valves. The end of the pump column is shown on the right in Fig. 2.

The method of installing the air lift is of considerable technical interest, as the details of such installations have seldom been published. The procedure, after ascertaining that the upper part of the compartment to be used was free from obstruction, was first to assemble all necessary pipe and equipment at the surface. For this purpose 900 ft. of 10-in. oil casing, 200 ft. of 12-in. machine-wound redwood stave pipe, and 1,200 ft. of 4-in. air pipe were secured and piled on the surface at a convenient distance from the shaft collar. The temporary wooden headframe, Fig. 1, was strengthened by an outer four-post frame and a single-drum, air-driven hoist placed in position. In the meantime a number of wooden crossheads were constructed. The plan was to place a crosshead every 100 ft. along the pipe line.

A crosshead, Fig. 2, consists of an upper and lower skid piece, each 7 ft. long, with curved ends, engaging with the upper and lower side of each guide; two additional skid pieces are provided for the inner faces of

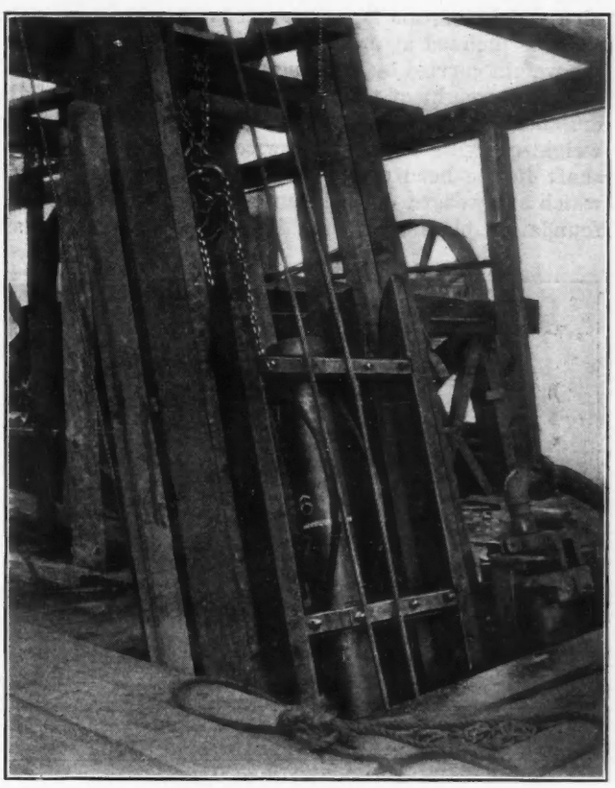


FIG. 2. CROSS-HEAD USED TO SUPPORT PIPE IN SHAFT

the guides. Thus, each shaft guide has three skid pieces on the three faces. The six skid pieces are held together by upper and lower platforms, each of which consists of two boards which are gained into the skids to hold them securely. A semicircular opening is cut in each board for the pipe. Rods extend through the boards, and four rods extend from side to side, binding the whole into a compact structure.

The crosshead is made in two parts, so that it can be slipped into place on either side of the pipe at the shaft

collar. When it is in place, the tie rods in the platform boards are inserted and tightened up. Ample clearance is allowed between all parts coming in contact with the guides. The crosshead is placed just below a pipe coupling, so that the weight of the pipe will be taken up by the coupling bearing on the upper platform of the crosshead.

To support the weight of the pipe and the attached crossheads, a piece of 1-in. wire rope is looped around the pipe, the ends of the rope being secured by a crosby clip. The loops are placed above and beneath the pipe, and below the upper and lower platforms of each crosshead, respectively. The looped rope is attached by clips to the two 1-in. cables, which are used in lowering the pipe and which must support a considerable part of the weight. Just how effective such a fastening is raises an interesting point, but inspection of the crosshead which became exposed as the water was lowered showed everything to be in good order, and no trouble of any kind was experienced with this method of fastening as further depth was reached. The illustration Fig. 2 shows one of the crossheads, the rope loop, and the two supporting cables, from which the rope clips have been removed.

The total length of the pipe that it was planned to use was 1,100 ft. With a weight of 22.75 lb. per ft., the total pipe weight of this length would be 25,000 lb. As the shaft is inclined at an angle of approximately 70 deg., the weight carried by the ropes may be roughly assumed to be the weight of the pipe, leaving the weight of the crossheads to be taken care of by the guides. The two weight-carrying ropes pass twice around a 12-in. steel shaft in the headframe and back to two heavy posts, which are wedged down in an opening between two old foundation blocks, Fig. 3. Each rope is wrapped six

FIG. 3. WIRE-ROPE ANCHORAGES FOR TAKING UP WEIGHT OF AIR-LIFT PIPE

times around a single post and extends to a wooden reel, from which it is payed out as lowering necessitates. As additional depth was obtained, a greater number of wraps became necessary. One or two additional turns at a time made it possible easily to control the weight.

The method just described was successful in lowering the pipe to a depth of over 700 ft., at which point an obstruction was encountered. In spite of releasing the whole weight of the pipe, further lowering could not be accomplished, and it was decided to remove the upper portion, 160 ft. in length, connect the 12-in. stave pipe in its place, and then operate the lift, recovering as much of the mine as the submerged length would permit. To remove the upper portion, the pipe was disconnected at a flange coupling, a hoisting rope attached, and the pipe lifted, each pipe length being removed as it reached the surface. This was being done at the time the photographs accompanying this article were taken. As an upper length reached the surface, it was secured by chain and triplex block, unscrewed, swung away from the shaft, lowered onto a small carriage, and removed to the pile.

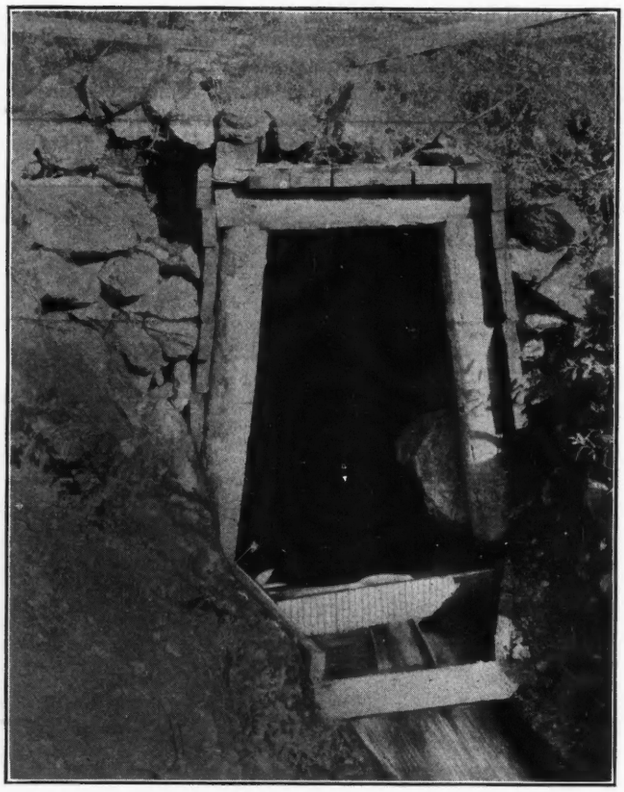


FIG. 4. MEASURING WEIR AND DRAINAGE ADIT

Although the length of pipe planned for was 1,100 ft., the greatest length used at any time was 700 ft. When the lift pipe stuck in the shaft, the water was lowered to the 400-ft. level, where a pump was installed. By air lifting to this level, the trouble point was reached at 686 ft., and the lift pipe was slid from this point to a point 1,013 ft. from the surface. From this position the 800 level was unwatered and a pump installed on this level. From the 800 level down, the mine was unwatered to a point 47 ft. above the 1,000-ft. level by means of an air lift in the 10-in. Cornish pump column extending from the 800 to the 1,000-ft. level. At this point the air lift could just handle the incoming water, so that three compressed air pumps and two weeks' time were required to remove this depth of 47 ft. and unwater the 1,000-ft. level.

The upper main air lift unwatered the mine to a point 560 ft. on the slope, or 519 ft. vertically, in just about one month's time. The maximum capacity attained was 1,450 gal. per min., with 49 per cent submergence with 97 lb. of air. The capacity dropped off to about 250 gal. per min. with 60 lb. of air with 18.3 per cent submergence. The shaft flattened from 72 deg., at surface

to 62½ deg. at the bottom of the 10-in. lift pipe. The lower air lift was unwatered from 560 ft. on the slope to 886 ft., a vertical distance of 282 ft. The capacity varied from about 1,500 gal. per min. with 77 lb. of air to about 200 gal. per min. with about 50 lb. of air and 19 per cent submergence. The shaft through this portioned flattened from 62½ deg. to 49 deg.

As has been stated, the water from 886 ft. to 1,068 ft. was removed through the 10-in. Cornish pump column, which extended from the 1,000 to the 800 level. This lift had enormous capacity, as upon starting there was a heavy submergence with small lift, and in one twenty-four hour period the water was lowered a total distance of 50 ft. on the incline.

The discharge from the shaft is measured by a weir, which is shown in Fig. 4. This weir is provided with a sliding gate, by means of which a constant height of discharge can be maintained.

The plan has worked out excellently, and the mine has been unwatered rapidly, with none of the discomforts and inconveniences incident to the use of pumps for work of this kind. A large amount of repair work was necessary, and while this was being done the water did not interfere at any time with the shaft repairs, as it was a simple matter to keep it well below the point where the work was being done. In this way alignment and grade were more easily kept, there were no pumpmen traveling up and down the shaft for supplies, and, besides, there was entire freedom from the excessive noise which accompanies most pumping operations.

For permission to visit the work and for much of the foregoing data I am indebted to John A. Fulton, manager of the Idaho-Maryland Mines Co., and I take pleasure in here making due acknowledgment.

Density Determination of Semi-Hard Ores

By R. H. McHARDY
Written for *Engineering and Mining Journal*

FOR purposes of estimating the tonnage of iron ore removed from drifts and raises at the Harold mine, Hibbing, Minn., a modified method of determining the density factor was devised. Formerly the practice in determining a density factor was to use the "oats method," which is described as follows: The floor of the drift is leveled off, a hole carefully excavated and the ore weighed as it is removed. Oats are poured into the hole, and the volume necessary to fill it is carefully measured. Having the weight of the ore removed, and the volume of the hole (or volume of oats necessary to fill it), the density of the ore may then be calculated. It has been found that the size of the sample which can be taken by this method is limited to about one hundred pounds. The reason for this is that the top of the hole is kept as small as possible, a pear-shaped excavation being made so that the error in leveling off the oats will be negligible.

Upon examination of certain drifts in the Harold mine it was apparent that the ore removed in drifting was very different from that in the bottom of the drift. This was especially true where the drifts were driven along the hanging wall, due to layers of sand lying between layers of ore. Therefore, in order to obtain accurate results, a test had to be made of the ore on the sides of the drift. After many suggestions, the following method was proposed by R. H. Bassett, chief engineer for the M. A. Hanna Co., and upon trial was found to be very satisfactory:

A box was constructed of one-inch lumber, as illustrated in Fig. 1. Channels were cut in the sides of the drift, and the box was grouted in with clay, as shown in Fig. 2. The door was then closed, and oats were poured in the top, filling the space between the rough wall of the drift and the inside of the box. The oats were carefully measured as they were poured, the door opened and the oats removed. A sample of ore was then cut from between the channels inside the box, care being taken to get the weight of all that was removed. The door was again closed, and a measured quantity of oats used to fill up the space inside the box. The difference between the volume of oats used before and after the sample was removed gives the volume of the sample. From the weight of the sample and its volume the density of the ore can be calculated.

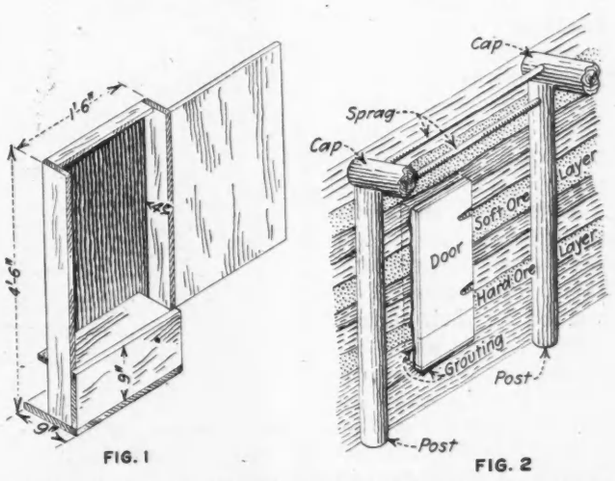


FIG. 1 FIG. 2

DEVICE USED TO DETERMINE DENSITY OF IRON ORES

For accurate results certain precautions were necessary. Three containers for measuring and pouring the oats were used—a gallon measure, a quart measure, and a small tin cup. The larger measure was for speeding up the pouring at first, the smaller ones being used toward the end, so that the error in measuring up a portion of a cup for the final pouring would be negligible.

Although the oats run freely and fill all crevices, they have a tendency to pack. There is considerable difference in the quantity a measure will hold, depending on how thoroughly the container is shaken when filled. In pouring the oats in the box, the quantity necessary to fill it increases as the box is tapped, so that to obtain accurate results a regular system of shaking the container and tapping the box was established. If the box is fixed strongly in place, the accuracy increases with the increased packing of the oats in the pouring container and box.

The advantages of this system are that a more representative sample of the ore to be tested can be taken, and the size of the sample may be increased without accompanying decrease in accuracy.

Lake Superior Iron Ore Shipments during 1919, according to official figures issued by *Iron Trade Review*, totaled 48,812,522 tons. Of these shipments, 47,177,395 tons were Lake shipments, rail shipments being 1,635,127 tons.

Government Officials Who Influence Mining

William Sloan

FAVORED with a robust constitution, and imbued with the spirit of adventure, William Sloan and three associates started for the Yukon in January, 1896, attracted by the vast and then comparatively unknown wilderness of the last Great West. The usual hardships and privations were encountered and overcome, and, after a fruitless summer spent in prospecting on the headwaters of the Stewart River, the party decided to try their fortunes on the lower Yukon. Luck was with them. The rush to the Klondike had just begun, and they were among the first to locate claims in that region, Sloan himself staking No. 15 on Eldorado Creek, one of the banner claims. Their shaft was the first to reach bed rock, and, striking "pay," they were amply rewarded for their efforts. So it is that, when Mr. Sloan, who is the present Minister of Mines of British Columbia, can be induced to talk of his Yukon experiences in the early days, he says, "the North has been good and kind to me." Sloan is one of the interesting personalities of British Columbia, and is a man of marked individuality. His early years were passed in his native Province of Ontario, where he was born, of Scotch descent, in 1867. His education was acquired in the public schools and collegiate institute at Seaforth, Ont. Upon terminating his student days he went to Shangahi, China, to join his father, Dr. R. J. Sloan, who at that time was one of the port physicians there. In 1887, the younger Sloan returned from the Orient to Canada and settled in British Columbia.

WILLIAM SLOAN

Following his big strike in the Yukon, Sloan mined for two seasons, and then returned to Nanaimo, B. C., where he built his present home. Two years later, in 1900, in the Canadian general election, he entered public life as a candidate for Parliament on the Liberal ticket, but was defeated. In 1904 he was a candidate for the district of Comox-Atlin, and was elected by acclamation and was re-elected in the same fashion in 1908. He resigned his seat in 1909. In the general elections of 1911, owing to repeated efforts of many of the influential members of his party to have him again enter the field, he issued an emphatic statement that he was not a candidate for re-election. As a member of Parliament from Comox-Atlin, the district embracing the larger portion of the coast line of British Columbia, he was successful in securing needed aids to navigation, including the hydrographic survey, as well as extension and improvement of the postal and telegraphic service. His attitude on the Oriental question has been that "Canada should control her immigration from within, and not be dictated to from without." At the general provincial elections in 1916, Mr. Sloan was elected by an overwhelming majority for Nanaimo Riding, and was confirmed by acclamation upon accepting the portfolio of Minister of Mines in the government formed under the premiership of the late H. C. Brewster. As might be expected in one who has lived so rugged a life, Mr. Sloan finds his chief recreation in hunting and fishing, in both of which he excels, and has traveled extensively in the wilds of Canada, from ocean to ocean, in pursuit of these pastimes. His home at Nanaimo contains many trophies from his hunting experiences. He is an ex-president of the Nanaimo Caledonian Society and is prominent in Masonic circles. For several years he was Liberal organizer for Vancouver Island and treasurer for the British Columbia Liberal Association, but resigned these offices on his election for Comox-Atlin. He is a member of the Rideau Club of Ottawa, the Union Club of Victoria, and the Vancouver Club of Vancouver.

For a man who is still comparatively young, Sloan has had a most interesting and varied career, as it has embraced many experiences of the pioneer, prospector, and politician. The office he holds seems a fitting climax to all that has gone before, as one traces his rise by successive steps from the prospector of the Klondike to the Minister of Mines.

The Minister of Mines and others holding similar positions should above all things have an intimate knowledge of the mining industry and the problems that confront it. The situation in British Columbia is in marked contrast with that in Ontario, and there will be few to deny that the western province is the more fortunate.

By The Way

Between Two Evils

News comes from California that Cox is the Democratic nominee. Speaking of the long deadlock between Palmer, McAdoo and Cox, Bryan said that the convention was looking for a man who would "respond without protest to every demand that comes from the White House, from Wall Street, and from the liquor interests." Not being able to get all three, they finally decided on one. With cheer leaders, shouting prolonged by prearranged plan, and other devices that school boys are familiar with, our two great conventions have been held, while Europe watched. "The Palmer people" said a dispatch, "assisted by the band and the great pipe organ, started a demonstration with a view to holding their lines fast." Were it not so comic the spectacle of the utter collapse and failure of our primary system would be seen for the national tragedy that it is.

Need for Restraint

"Don't thee think for a minute, m'son, that Jan Trembath be a fool, even though 'is affairs of tha 'eart be, as I mus' h'admit, far from brilliant," said Cap'n Dick. "Times 'e wuz smart enough for anyone, as super to tha Warrior foun' h'out one day. Jan at that time wuz workin' as shif'boss on sixth level o' tha Warrior, an' one Tuesday—or per'aps it were Wednesday—Jan 'e brings tha 'ol crew to surface baout 'leven-thirty in tha moornin'. So 'appened w'en they wuz steppin' h'off tha cage along comes tha super. 'W'ot tha 'ell do'st thee mean by comin' h'up this time o' day?" sez 'e. An' Jan sez, 'Mister 'Atch, tha h'air is so bad in nummer two stope tha bloody cannels won't burn. Mert Morcom 'ere, 'e pretty near got knocked h'out—h'asfixiated, as tha doctors say—an', dam-me, Mister 'Atch, I won't work no man in h'air as bad at that.' 'H'air 'ell,' sez 'Atch, 'You're fired. Go to tha h'office an' get your time!' An' Jan sez, 'H'all right Mister 'Atch, I'm fired, but I 'ope thee will not fire Mert Morcom—'e's got a wife an' twelve children an' 'e needs tha job.' 'I'll 'fire 'oo I damn please,' sez 'Atch. 'I naws thee will,' sez Jan, 'but I wuz jus' h'askin' thee not to fire 'e, an' please don't fire Si Johns, tha surface boss. An' there's Tommy Williams—no better blacksmith h'ever put h'iron in the fire than 'e. An' before I get my time, Mister 'Atch, will 'e do me a bit o' a favor?' 'W'ot do'st thee want?' sez 'Atch. 'Will thee please go to Tommy Williams an' h'ask 'im to take a piece o' h'iron 'alf by three an' forge a ring out'en about so big around?' 'W'ot for?' sez 'Atch. 'So thee can wear it for a 'at band an' keep your damn 'ead from bustin,' replied Jan."

It Pays To Advertise

Bulletin No. 7 of the Minnesota School of Mines Experimental Station, entitled, "The Future of the Lake Superior District as an Iron-Ore Producer," and compiled by Edward W. Davis, concludes in this pungent paragraph:

"If there is any criticism to be passed upon the mining men of the Lake Superior district it is that they have kept their achievements too much to themselves. They have been satisfied to make a large amount of worthless land extremely valuable, and have not taken the trouble to explain their work to the people at large. This is a period of great publicity and wide advertising, and the mining industry must realize this fact to keep abreast of the times."

Smelter Smoke

Miami, Ariz., led all the rest of Gila County in births registered in the month of May. Globe came second and Hayden third. Smelter towns are usually noted for their high birth rate, the sulphur fume apparently affecting only vegetation. Copper Cliff, Ont., was reputed to have the highest rate in Canada. Some interesting statistics could be gathered on this subject. To study the health and welfare of the workers is of the highest importance.

The Amateur Geologist

A report on certain lands in Texas, by Bagnall and Daniel, geological engineers, of Chillicothe, Tex., according to the version given in the *Wichita Oil Reporter*, gives several reasons why oil should be found in the area, one of which is that "Oil is always found at or near *anticlinical* domes which run parallel to mountains or hills," and another, "The surface conditions and principal earmarks as found in the same." We imagine the clinical (or anticlinical) problem has to do with the earmarks. "The structure," they say in summarizing, "is of the Permian formation, and one of the most perfect structures we have ever examined. We have found the rock exposures dipping from the structure at various angles and in all directions. The surrounding hills form a semicircle around the dome, thus completely inclosing and hermetically sealing the structure." The poetry of petroleum will seep out. We imagine the stage is set at night—yes, it must be night. In the center is the mysterious and perfect Structure, the most perfect yet dimly viewed by man—so Perfect that the rock exposures (we knew some day they would be exposed) dip and duck away from It in all directions and in confusion. And well they may, for the silent cordons of hills have formed a protective semicircle around the perfect Structure, thus completely inclosing it. When they have gathered still closer, and formed a complete circle—what shall we say? Apparently they can do no more than completely inclose it, but we feel some unthought-of climax will come. What is the dénouement? How can we wait for the continuation of the reel next Saturday night?

Variety the Spice of Life

In the long run diversified industry is best for any mining district. Occasionally, however, the mine manager whose company has to compete with other industries for its labor supply may wish that he were not so happily conditioned. Recently, operators of the Joplin-Miami district have been greatly hindered by car shortage, and to make matters worse many of the miners have left to work in the wheat fields. The result is curtailment of operations. But it is a good thing for the men, and indirectly a good thing for the companies, even though not appreciated. That which is best is not necessarily pleasing. A maternal castigation is said to be good for the soul, though painful.

CONSULTATION

Important South African Gold Mines

"Can you let me have a list of the twenty largest gold-producing companies in South Africa and figures showing the current rate of production?"

The principal gold-mining companies in South Africa rank in the following order in point of production. In each the production is given for the month of March, which is the latest month for which these figures are available. The compilation is made from figures furnished by the Transvaal Chamber of Mines:

Name of Company	Ounces of Gold Produced in March, 1920	Name of Company	Ounces of Gold Produced in March, 1920
Crown Mines	59,402	Springs	7,524
Government Areas	51,521	Robinson Deep	17,207
New Modderfontein	46,206	Consolidated Main Reef	17,033
Randfontein	40,712	Knights Deep	16,194
E.R.P.M.	33,389	Geduld Proprietary Mines	15,990
Van Ryn Deep	28,385	Nourse Mines	15,106
City Deep	25,317	Rose Deep	14,680
Modderfontein B.	23,396	New Kleinfontein	14,100
Modderfontein Deep	23,512	Village Deep	13,823
Brakpan	21,093	Geldenhuis Deep	13,060

Infusorial Earth Market Possibilities

"I have been referred to you by our State Bureau of Mines and Geology for information regarding the possibilities of marketing diatomaceous earth which I have here in large quantities. This is quite pure on analysis and contains little else than silica and water. Can you advise me of the best method of getting in touch with prospective purchasers?"

Infusorial or diatomaceous earth has many uses, all of which combine to influence the market for this product. An enumeration of these applications would include the use of the material as a cleanser and polisher in the form of a powder or mixed with soap, as a non-conductor of heat, either alone or in conjunction with other materials; as a covering for boilers, steam pipes, furnaces and stoves; and in the manufacture of fireproof cements. The great absorbent quality of infusorial or diatomaceous earth makes it suitable for water filters. Owing to this characteristic it was formerly employed in the manufacture of dynamite. It is used in the manufacture of talking-machine records when boiled with shellac. Another use is as an absorbent for liquid manures to make them more adaptable as a fertilizer. The manufacturers of water glass, various cements, tile glazing, artificial stones, pigments of alizarine, and aniline colors consume much infusorial earth. Minor uses include paper filling, for sealing wax, in fireworks, matches, papier-maché, as liquid bromine containers and other miscellaneous purposes. Its use as a building stone in California is worthy of note, as well as its employment in the manufacture of plaster.

Infusorial earth is of widespread occurrence, although we believe that the largest domestic deposits are found in the Western United States. On the other hand, the greatest demand for this material is in the East, so that the price received for the Western product is lower, because of the heavy transportation charges to the principal markets. Prices vary considerably and depend upon the quality of the infusorial earth—as in most non-metallic products—and upon the location of the deposit.

Prices range widely from $6.50 to $10 for the Western grade, and from $13 to $30 for the Eastern product, f.o.b. mines.

In marketing your product you would have the choice of using dealers or communicating directly with consumers. In the latter event it would be well to cultivate a local market as far as possible through communication with local manufacturers of products consuming infusorial earth. The list of uses given above will serve as a guide to this end. The other alternative, marketing through dealers, is easier but naturally has its disadvantages.

Western Acid Producers

"Can you tell me if there are any manufacturers of sulphuric acid extracted from sulphide ores in Arizona or other points west of Denver?"

To the best of our knowledge no sulphide ore is being mined in Arizona for its sulphur content alone. The sulphur, when recovered, as at the smelter of the Calumet & Arizona Copper Co., at Douglas, is produced as a byproduct from the smelting of copper ores. Under existing conditions the numerous pyrite deposits would undoubtedly have difficulty in marketing their product profitably, owing to heavy mining and transportation costs to the chief markets.

California has extensive pyrite deposits, but because of their great distance from the East, where sulphuric acid is chiefly consumed, their development has been retarded. California's greatest pyrite producer is the Mountain Copper, at Keswick. Manufacturers of sulphuric acid in the Far West are small in number. We believe that the Barbour Chemical Co., Stauffer Chemical Co., Union Superphosphate Co., Leona Chemical Co., and Mountain Copper Co., all of San Francisco, comprise the list.

The Molybdenum Ore Market

"Will you kindly advise me as to the price and present demand for molybdenum ore? How can I get in touch with parties who will buy this ore?"

The present demand for molybdenum ore is small, and hence the market is dull. The technology of molybdenum is not sufficiently understood to warrant alloy-steel manufacturers employing large quantities of this metal. Other uses for molybdenum, such as in electrical apparatus and the manufacture of chemicals, are too unimportant to help sustain the market. As in some other metal markets, the dealings in this class of ore are frequently attended with an inordinate amount of secrecy, inquirers and buyers alike maintaining reticence on their dealings. Owing to the small trade in the ore, accurate metal quotations are difficult to obtain, and at present the sole offerings seem to be foreign molybdenum ore at 60@65c. per pound of MoS_2 contained.

THE PETROLEUM INDUSTRY

Probable Oil Resources of New Mexico

A Summary of the Stratigraphic and Structural Geology of the State, With Particular Reference To Possible Sources of Petroleum—Some Oil Has Been Discovered, And a Few Localities Are Promising

BY JOHN K. KNOX*

THE interior of the United States west of the Mississippi River is commonly divided into three great, major topographic provinces, the Great Plains, the Cordillera, and the High Plateau. Each of the three regions is represented in New Mexico. The state is divided into three sub-equal parts by the Rio Grande and the Pecos rivers, and these three areal subdivisions correspond roughly with the topographic subdivisions. East of the Pecos are the Great Plains. Between the Pecos and the Rio Grande, and extending into the southwest corner of the state, is the Cordelleran area. To the west of the Rio Grande is the High Plateau.

The three great provinces are distinct topographically, and are well defined geologically, both in stratigraphy and structure. In the Great Plains region of New Mexico a thin covering of Tertiary formations unconformably overlies beds of early Mesozoic and Paleozoic age. The Tertiary formations lie nearly flat, and the subjacent beds normally dip gently eastward from the Cordillera into the great syncline which runs north and south through western Texas. This region may be divided conveniently into three districts: (1) an area in northeastern New Mexico where the surface formations are Tertiary or Cretaceous; (2) the area around Santa Rosa and Tucumcari, and in the Pecos Valley, where most of the surface formations are Permian or Triassic; and (3) the Llano Estacado, where the surficial beds are Tertiary.

The rocks outcropping in the Cordilleran area range in age from pre-Cambrian to Tertiary, but Pennsylvanian formations probably are most widespread. The beds are much folded and faulted and stand at angles ranging from a few degrees to more than ninety degrees from horizontal.

The High Plateau is underlain by a great thickness of nearly horizontal strata, ranging in age from Tertiary to Pennsylvanian. Streams have cut deep gorges across the plateau and have dissected it into a network of mesas of widely differing area and height. The plateau is more nearly a unit geologically than is either of the other major areas, but it may be divided conveniently into two parts, the San Juan Basin, in the north, and the Magdalena district, in the south.

The Tertiary formations of the Great Plains, consisting of poorly cemented sand, clay, and gravel, outcrop over much of eastern Union County. It is not known with certainty what formations underlie the Tertiary in this region. One hundred miles to the southeast on Canadian River, in the Texas Panhandle, similar Tertiary rocks overlie Triassic and Permian. In western Union County the Dakota sandstone appears from under the Tertiary, which lies unconformably upon it, but it is not known how far east the Dakota extends under its Tertiary cover. This is not of great importance, however, as the Dakota is not an oil-bearing horizon. The Tertiary area in northeastern New Mexico is not of great interest to the oil producer.

West of the Tertiary area in Union County, the Dakota and Purgatoire sandstones outcrop over a large tract in Union, Colfax, Mora, and San Miguel counties. These rocks have been deformed and folded, and at least one anticline of considerable size is present, but despite these facts, the area where they outcrop is not attractive as a prospective oil field.

Even more important than the character of the Dakota is the lithology of the underlying formations in which oil would be expected. If 4,000 ft. is accepted as being about the greatest depth to which a well can be drilled profitably at present, there is little chance of finding valuable petroleum deposits by drilling in the areas in northeastern New Mexico where the Dakota and Purgatoire sandstones appear at the surface, because the 4,000 ft. of beds immediately underlying the Dakota do not offer much chance of production. A number of wells have been drilled, and some are being drilled now, in the neighborhood of Des Moines, but none of them have shown signs of commercial production.

When examining structures in northeastern New Mexico with oil development in view, it is necessary to make sure that the structural form is not caused by an igneous body of the laccolithic type. Certain determination of this condition is not always possible, but the possibility must be given greater weight when evaluating a structure in this region. If the laccolith is buried deeply enough, and has not pierced the productive oil horizons, oil will collect on the structure if other conditions are favorable, and the fact that a structure is of laccolithic origin need not necessarily condemn it as a possible producer of oil. In this region, however, the chances are that if a laccolithic structure is sufficiently marked to be determinable as a structure, the igneous rock is probably so close to the surface as to make the likelihood of obtaining oil very remote.

West of the outcrop of Dakota sandstone, younger Cretaceous formations are exposed in a broad belt in the valley of the Canadian River. This Cretaceous area, sometimes spoken of as the "Raton field," is the most promising area for future oil production in northeastern New Mexico.

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The plain of the Canadian River Valley is underlain by the great shale series of the Upper Cretaceous, which includes beds ranging in age from Dakota to Pierre. The shale of the Benton and Pierre groups is of the type which commonly produces oil, and it is probable that a well drilled into these shales at almost any point would show traces. In Wyoming, where the same formations have an almost identical appearance and composition, they produce oil.

Unfortunately, a careful search of the Cretaceous section in the Canadian Valley, from the top of the Pierre to the base of the Benton, has failed to disclose a single bed of sandstone which could act as a reservoir for the oil produced by the Benton and Pierre shale. It is possible that lenses of sand are present in the area, but no such lenses are known to outcrop. The only reservoir horizons in the Cretaceous section in this district appear to be the Timpas and the Greenhorn limestones. In these formations the limestone is thin-bedded, and the individual beds of limestone are separated by thin beds of impervious shale. Such a lithologic condition does not produce a good oil sand, but it does not make the storing of oil impossible, and oil may be present in these limestones somewhere in the district. It should be noted that nowhere along their outcrop, so far as I have observed, do these limestones show traces of oil or gas, and although this fact does not prove that they are barren everywhere, they may be assumed to be so over considerable areas.

In the absence of good reservoir horizons, it becomes of the utmost importance that any well drilled be situated on a favorable structure, so that it may have some chance of success, but the absence of sandy horizons in the shale makes it difficult indeed to detect such structures. In most places the surface is mantled by from two to twenty feet of weathered shale or river deposits, which yield no information concerning the subjacent structures, and even where the unweathered shale is exposed, no definite beds can be traced. The Cretaceous area in the valley of the Canadian River is the most promising territory for oil in northeastern New Mexico, but even it does not offer good prospects of becoming an important producer.

Raton Mesa District Geologically Unfavorable

The Raton Mesa district, west of the Canadian Valley, is underlain by Tertiary formations which are not likely to produce petroleum. Beneath the Tertiary, and overlying the Pierre shale, are 525 ft. of sandstone and shale belonging to the Trinidad and Vermejo formations, which are Cretaceous in age and younger than the Pierre. The Trinidad sandstone is 100 ft. thick and lies immediately on top of the Pierre, so it is not improbable that oil which may have originated in the Pierre shale might, under favorable structural conditions, collect in this sandtone. There is no competent bed of impervious rock above the sandstone, however, and it is more than likely that any petroleum which may have migrated to the sandstone has already escaped. A well to test the Trinidad would be justified, however, if placed on an especially favorable structure.

Large anticlinal structures bring Cretaceous rocks to the surface in a number of places in the Raton Mesa district. Vermejo Park, which is probably the best known of these, is a large and well-defined anticline, and would be an attractive drilling site were it not for the doubt as to the presence of reservoir horizons in the Cretaceous formations underlying it. Structurally it is satisfactory, and it is probably the best place in which to test the Cretaceous formations of the district if anyone is willing to drill such a test in face of the unfavorable lithologic conditions. A well 3,500 ft. deep would afford a good test of the Cretaceous.

Santa Rosa-Tucumcari Region Unexplored

Throughout the Santa Rosa-Tucumcari region the surface formations belong to the great "Red Bed" series of central New Mexico. No part of this district has been studied in detail geologically, and the exact age of many of the formations is not known. The Dakota-Purgatoire sandstone at the base of the Cretaceous, and the underlying Morrison shale, are readily recognizable, and the boundary between them and the subjacent formations has been traced with approximate accuracy. The 4,000 ft. of sediments immediately underlying the Morrison belong to the Triassic, Permian, and Pennsylvanian systems. The Magdalena limestone at the base is definitely known to be Pennsylvanian, but on account of the paucity of fossils the upper beds are not readily classifiable as to age.

A massive sandstone, for which I propose the name "Pecos Canyon," divides the "Red Beds" which overlie the Magdalena into two groups: (1) the upper "Red Beds" and (2) the lower "Red Beds." The upper "Red Beds" are probably Triassic; the lower "Red Beds" are Permian or Pennsylvanian or both.

Lithologically, the "Red Beds" are unpromising as a source of petroleum. Nowhere in the series is there an appreciable thickness of marine shale or other bituminous, oil-forming lithologic type, and, except in one locality a short distance north of Santa Rosa, no evidence of the presence of petroleum in the sandstones is to be noted.

Favorable-looking structures are plentiful in all the Santa Rosa-Tucumcari region, and on account of the similarity of the formations, and of the surficial conditions, to formations and conditions at Burkburnett, operators have devoted much attention to the district within the last year. During 1919, a well was drilled on Los Estaritos dome in T. 11 N., Rs. 18 and 19 E. Judging from surface indications, this dome is almost perfect. It is regular in shape, is of good size, has ample closure, and should contain oil, if oil is present in the district. The well spudded in in "Red Beds" and drilled through "Red Beds" until it passed into granite between 1,900 and 2,000 ft., without finding oil. This well brought out two significant points: (1) that the Magdalena limestone is not present on Los Estaritos dome, although it is 1,800 ft. thick only thirty-five miles to the northwest; and (2) that the domal structure possibly owes its origin to renewed movement along an old line of granite hills which are now concealed by only a few thousand feet of Paleozoic sediments.

The presence of granite under Los Estaritos dome at the comparatively shallow depth of 1,900 ft. suggests that many, if not all, of the numerous structures lying between the Sangre de Cristo foothills and the Texas line may owe their origin to renewed movement along an old line of mountains, and that they may be as barren of oil as is Los Estaritos. It is worthy of note that the folds which are producing gas in the Texas Panhandle, due east of Santa Rosa, have a general east-west elongation, and some geologists are suggesting that a range of eroded and buried mountains extends from the Sangre de Cristo into Texas.

In view of the non-petroliferous character of the lower and upper "Red Beds," the probable absence of the Magdalena limestone from much of the disturbed area east of Los Estaritos dome, the non-bituminous character of the Magdalena even where found, and the probability that the observed anticlinal structures in this district are underlain at shallow depths by granite or very old metamorphic rocks, the "Red Beds" area in the Santa Rosa-Tucumcari region is not an attractive oil prospect.

The Lower Pecos Valley Not Commercially Productive

Oil in less than commercial quantities has been found for many years in shallow wells in the Pecos Valley between Roswell and Carlsbad. The central part of the valley is floored by a thick mantle of Quaternary river deposits, flanked on the east by "Red Beds" and on the west by porous limestone of Permian age. The "Red Beds" are so unfossiliferous that certain determination of their age is difficult, but some part of the series is Permian, and part is possibly Triassic. Under the "Red Beds" is an immensely thick series of Pennsylvanian and Permian limestone.

The regional dip of the sedimentary series is to the east, decreasing from more than ten degrees at the crest of the Sacramento Mountains to nearly zero on the plains. Small anticlinal folds are not plentiful where the consolidated rocks can be studied on the long slope from the mountains to the Pecos, and in the central part of the valley, floored by Quaternary formations, it is not possible to determine by surface indications whether such structures exist or not.

A considerable number of wells have been drilled in the Pecos Valley during the last fifteen years, and, although none have been commercially profitable, enough oil has been found to keep hope alive, and interest and drilling still continue. The wide area west of the Pecos where limestone is the surface formation is unpromising territory, because any oil that may have been in the limestone has probably escaped, and the limestone itself is so thick that it cannot be pierced. The area mantled by Quaternary deposits is difficult prospecting ground, and, apparently, most of the drilling has been done blindly. Old methods can probably be improved, however, for a careful study of the logs of the numerous water wells that have been drilled in the valley should make possible a fairly close approximation to the sub-surface structure.

A favorable structure can be more easily located in the "Red Beds" area east of the river, and a favorable structure in this district would certainly be worth a test. The present small production is obtained from porous beds in the upper part of the limestone series which underlies the "Red Beds," and if even a small production could be maintained it would be profitable, as the wells are shallow and inexpensive to drill. Oil is a widely distributed mineral, however, and nothing so far found proves that commercial deposits of it are present in the Pecos Valley.

Llano Estacado Region Unfavorable

The surface formations of the Llano Estacado are Tertiary in age, and beneath them lie the Triassic, Permian, and Pennsylvanian beds, which outcrop to the east and west of the Staked Plains. The continuity of the older rocks is fairly well established.

There is no reason to suppose that oil will be found in the Tertiary deposits themselves, and before drilling is undertaken in an effort to discover sub-Tertiary structures, it should at least be known that the sub-Tertiary formations contain oil. Nothing indicating the possibility of commercial production from these beds has yet been found, and at the present time the Llano Estacado must be regarded as one of the least favorable regions in New Mexico in which to prospect for oil.

The High Cordillera Probably Barren

The High Cordilleran area of New Mexico is a region of high mountains, in which the predominating rock type is Pre-Cambrian granite. At the south end of the Sangre de Cristo Range Magdalena limestone lies on the granite, and the younger formations appear in their respective order and dipping gently to the south. The chances of obtaining oil in the High Cordilleran area or on its immediate borders are so small that the district may be considered as valueless as a prospective oil field.

The southern Cordilleran area of New Mexico comprises the mountainous region which extends through the centre of the state from the main line of the Santa Fe south to the boundary of Texas and Mexico, and southwest to the boundary of Arizona. This region is characterized by the "bolsom-fault-block" type of structure, which sharply differentiates it from the higher Cordillera to the north. The northern ranges are, commonly, great anticlinal folds modified by faulting. The sedimentary beds are steeply upturned in many places, and are altered where deformation has been most intense. In southern New Mexico there are no long ranges, the mountains are monoclinal rather than anticlinal, in only a few places are the beds steeply tilted, and metamorphism is rarely seen. The southern Cordillera consists of a series of short, relatively low mountain blocks which owe their origin to faulting, arranged in three fairly continuous north-south lines east of the Rio Grande. Except in the disturbed blocks, the formations dip gently to the east or southeast or lie nearly horizontal.

As possibly productive areas, the fault-block ranges themselves are not of interest, for in most of these blocks granite is exposed at the foot of the fault scarp, and the broken and upturned edges of the sedimentary formations outcrop. Oil is found elsewhere in mountainous areas where the rocks are closely folded, as in Ventura County, Cal., but the monoclinal fault-block structure of the New Mexican ranges has afforded no opportunity for oil accumulation.

West of the mountains is the debris-filled plain of the Rio Grande. Between the individual mountain blocks lies a series of shallow undrained basins known as "bolsoms," of which the larger and more important are Tularosa Basin, Estancia Basin, and Jornada del Muerto. These basins, and the valley of the Rio Grande, were once rather deep, but now they are filled to a depth of hundreds of feet by loose, unconsolidated Quaternary gravels and sands washed from the surrounding hills. However, if oil is found anywhere in south-central New Mexico, it is most likely to be found on minor anticlinal folds or along the fault line in the down-thrown and buried fault-blocks which lie concealed beneath the Tertiary valley fill.

Formations ranging from Pre-Cambrian to Quaternary outcrop in the southern Cordilleran region, but Pennsylvanian and Tertiary rocks are most widely distributed at the surface. In the El Paso region rocks

representing parts of Cambrian, Ordovician, Silurian, Devonian, Mississipian, and Pennsylvanian time are present.

The outstanding difference in the Paleozoic series in the northern and southern parts of the region is one of lithology. North of Socorro the Paleozoic section contains many thousands of feet of sandstone and shale, and a relatively small thickness of limestone. South of Socorro the thickness of sandstone and shale decreases rapidly and the limestone content increases even more rapidly as progressively older rocks appear below the Pennsylvanian.

The sandstone, shale, and gypsum which outcrop north of and around Socorro belong to the Manzano group of the Pennsylvanian. The rocks are for the most part red in color, and give absolutely no evidence of included bituminous materials. A careful study of the whole Manzano group has convinced me that it offers little or no chance of being an original source of petroleum.

The limestone which is present in great thickness at the base of the Paleozoic section in southern New Mexico does not contain an appreciable amount of bituminous material except in a few thin beds in isolated localities, but the future of this region as a producer of petroleum appears to be bound up with the limestone series. Structures favorable for the accumulation of oil exist in the basins, although they will be hard to find, and if the limestone or the shale included in it is an original source of petroleum, the probabilities for a large production of oil are good. On the other hand, if the limestone beds have not themselves produced petroleum, and serve merely as storage for oil which has migrated from some outside source, the prospects are discouraging. Most observers consider that marine shale is the original source of the greater part of the world's petroleum, and marine shale is conspicuously absent from the Paleozoic section in south-central New Mexico.

Comparison With Oil Fields of Mexico

Lithologic conditions in southern New Mexico are in some measure analogous to those in the oil fields of the Mexican coast. The Tamasopo limestone of Mexico is an immensely thick series, and enormous quantities of oil have been produced from the upper beds of this formation. The rock itself is not more bituminous than are many of the Paleozoic limestones of southern New Mexico, and it is reasonable to suppose, if the Tamasopo limestone produced the oil which is found in it, that oil may be found in the Magdalena or underlying limestone in New Mexico.

The important question is, Did the oil found in the Tamasopo limestone originate in the limestone itself? Over the Tamasopo limestone in Mexico lies a thick series of marine shales such as produce oil in many regions of the earth. The solution of the question as to the origin of the oil is dependent on determination of whether oil ever migrates downward from a superjacent shale to an underlying porous horizon. Opinion is divided on this subject, and proof, one way or the other, is difficult to establish, but it is certain that evidence of downward migration is rare. Probably the majority of operators believe that the oil found in the Tamasopo limestone originated in the overlying shales, but although this implies downward migration in a stratigraphic sense, it is doubtful whether it also implies downward migration gravitatively. The theory of the migration of oil is in a state of change at present, and many geologists are accepting the conclusion that petroleum does not migrate long distances, either horizontally or vertically, and that, in most instances, it is found not far from where it originated.

If those observers who believe that oil originates only in shales are correct, there is little hope that southern New Mexico will ever produce an oil field. In this region there is no marine shale lying over the limestone, but in its place there is a thick series of "Red Beds," which are not bituminous.

Conversely, if it were definitely known that oil originates in limestones, southern New Mexico would be well worth prospecting. The presence of small quantities of oil in the porous beds at the top of the thick series of limestones in the Pecos Valley has an important bearing on the prospects of the Cordilleran region farther west. If this oil did not originate in the limestone itself, no source for it is evident, and, whatever be its origin, it is reasonable to expect oil at least in similar quantity in south-central New Mexico, where lithologic conditions are entirely comparable.

A number of wells have been drilled in the basins of southern New Mexico, but most of them appear to have been located on acreage rather than on a favorable structure. Tularosa Basin recently has been a favorite haunt of the wildcatter, but as the valley fill is hundreds of feet thick over much of that basin, most of the wildcats are doomed to failure. I have made a rather careful examination of the Paleozoic section in southern New Mexico, but so little bituminous material was found in the rocks that I am inclined not to be optimistic over the possibilities of finding oil in commercial quantities in this region.

Plateau Province Should Prove Productive

In my opinion, the Plateau Province, west of longitude 106 deg. and north of latitude 34 deg., is the most promising region in the State of New Mexico in which to prospect for oil and gas. It is essentially an area of Cretaceous rocks. Pennsylvanian formations outcrop in many places, and Permian and early Mosozoic formations have a more limited distribution, but Cretaceous rocks predominate. When measured over long distances, the sedimentary beds are found to lie flat, or nearly so. Small faults with a moderate throw are numerous, and locally small well-defined anticlines afford excellent collecting areas for petroleum contained in the deformed beds.

If oil is found in the Plateau region it will probably be discovered in Cretaceous rocks, and chances of finding oil in these formations are bright. Great quantities of oil are being obtained from Cretaceous rocks in Wyoming, and the Wyoming Cretaceous is similar in all important respects to the Cretaceous of northwestern New Mexico. The Cretaceous areas in the San Juan Basin and the smaller Cretaceous areas northwest and west of Magdalena are probably the most favorable localities in the state.

The oldest rocks found in the district around Magdalena are Mississippian in age, and they are exposed over only a limited area. The Pennsylvanian formations are similar lithologically to the Pennsylvanian formations east of the Rio Grande, and the probability of finding oil on structures in the Paleozoic in this district is neither greater nor less than of finding it on structures in the Tertiary-filled valleys of south-central New Mexico. The surface of the Plateau is not

everywhere buried under a mantle of Tertiary debris, however, and chances of locating a favorable structure are much better than in the basins to the east and south. The Manzano group is probably considerably thinner than it is in the Rio Grande Valley, and on many structures a well 3,500 ft. deep would test the lower Pennsylvanian and the Mississippian. Operators who wish to test the Paleozoic horizons in this region should devote careful attention to the areas of Pennsylvanian outcrop around Puertecito and Magdalena.

The Cretaceous rocks exposed in the Magdalena district belong to the older formations of the Cretaceous group, no beds younger than Mesaverde probably being present. The rocks are similar to the corresponding formations in the San Juan Basin, and the district where they outcrop should share attention with the Cretaceous areas to the north.

San Juan Basin Worth Investigation

The San Juan Basin region includes the San Juan Basin and a fringe of territory extending on the east nearly to the Rio Grande and on the south to Mount Taylor Mesa and the Zuni Mountains. The northern boundary lies along the San Juan Mountains in southwestern Colorado, and to the west the basin extends into Arizona. The basin comprises the area drained by the San Juan River. In New Mexico this includes a circular area lying immediately west of the Continental Divide, and embraces the whole of San Juan County and parts of Rio Arriba and McKinley counties.

South of Gallup is another small basin, bounded by the Zuni Mountains on the east and drained to the west by Zuni River. This area, known as Zuni Basin, is geologically similar to the larger basin to the north and is commonly associated with it. The combined areas of the two basins is about 140,000 square miles.

The San Juan Basin is a basin both structurally and topographically, and on all sides the formations dip gently inward from the borders toward the centre. In the center of the basin is a broad outcrop of Tertiary rocks, approximately circular in outline, and around the Tertiary in bands of varying width and completeness are the Cretaceous and Pre-Cretaceous formations. Not all of the formations outcrop in complete rings around the Tertiary, but the similarity of the formations to a nest of decreasingly smaller saucers, piled one inside the other, holds. The Pre-Cretaceous formations in the San Juan Basin do not offer great promise of being productive of oil, and although they range in thickness from 1,300 to nearly 6,000 ft., they are of little interest to the oil producer.

The Cretaceous formations, on the other hand, give promise of yielding petroleum and merit careful study. They are commonly divided into five formations, the Dakota, Mancos, Mesaverde, Lewis, and Laramie. The Dakota sandstone commonly consists of a heavy band of sandstone at the bottom, a similar band at the top, with alternating beds of sandstone and shale and some poor coal between.

The Mancos is a marine shale of considerable thickness and wide distribution, similar in many ways to the Benton-Pierre shale series east of the Front Range. In many places the Mancos is very black, and in general is more carbonaceous than the Pierre, although less so than the Benton. Oil is found in many places in the Benton-Pierre series, and under structural conditions favorable for accumulation the Mancos ought to be as promising a primary source of oil as the Benton-Pierre group. In its type locality the Mancos shows no sand. In the neighborhood of Gallup the upper part of the Mancos consists of several hundred feet of alternating beds of sandstone and shale, with some coal, but the main body of the shale below shows no sandy members that can be traced, although lenses are found.

In its type locality on Mesaverde, in southwestern Colorado, the Mesaverde formation consists of a heavy sandstone at the base, a similar heavy sandstone at the top, and between these a thick series of alternating beds of sandstone, shale, and coal. The formation becomes thicker, more arenaceous, and coarser grained as it is traced southward across the San Juan Basin from its type locality, but it maintains the same general lithologic character. The whole series of upper Mancos and Mesaverde sediments indicate rapidly oscillating conditions of sedimentation in the lagoon or littoral zone of the sea in which the beds were laid down.

The Lewis shale is a greenish or greenish-gray sandy shale about 1,000 ft. thick in southwestern Colorado, but less than 100 ft. thick in the central part of the San Juan Basin. The shale is of marine origin, but does not appear to be highly carbonaceous.

The Laramie consists of a series of soft, friable, brown, tan, or buff sandstones and some shale and coal of both fresh-water and brackish-water origin. The Tertiary also consists of sandstone and shale. The rocks are coarse grained, soft, and friable, and have a characteristic greenish-white, greenish, or gray color, with some shade of tan in the sandstones.

If oil is found in the San Juan Basin it will probably be in the Cretaceous formations, because the Pre-Cretaceous formations do not exhibit any of the common evidences of oil, and are too deeply buried over most of the basin. Farther west, in the San Juan River field of northern Arizona, Pre-Cretaceous formations are yielding oil, and the Pre-Cretaceous section of that district merits a closer study than it has yet received.

Character of Prospective Oil Territory

It has been shown that two types of horizons are necessary before an area can be considered good prospective oil territory: bituminous horizons which supply the petroleum, and porous horizons in which the petroleum may be stored. The Cretaceous area in northeastern New Mexico is rich in shale which might be expected to produce oil, but it is almost destitute of storage horizons. The Pennsylvanian area of south-central New Mexico has a wealth of storage horizons, but bituminous oil-producing horizons are unknown. The San Juan Basin does not possess ideal conditions for the production and storage of petroleum, but conditions are more promising there than in any other part of the State of New Mexico.

Included in the Mancos, Mesaverde, and Lewis formations in the San Juan Basin there is from 800 to 4,000 ft. of marine shale, much of it black carbonaceous shale such as is abundantly petroliferous elsewhere in the Rocky Mountain region. The upper part of the Mancos and the Mesaverde together contain from 400 to 800 ft. of sandstone sufficiently porous to form admirable storage for migrating petroleum. Anticlinal structures favorable for the accumulation of petroleum are by no means rare, and it might be expected that, with both shale and sandstone present in adequate amount, oil will be found in commercial quantity under some of the best of these structures.

The chief infelicity in conditions lies in the dis-

tribution of the sandstones, which are all concentrated near the middle of the area, and it has been argued that the Cretaceous of the San Juan Basin will be unproductive, because no continuous and widespread beds of sandstone have been found in either the Mancos or Lewis.

A similar condition exists in Wyoming, where the chief production is obtained from the Wall Creek sandstone member of the Benton. The Wall Creek sand lies above a thick bed of Benton shale similar to the Mancos, and is overlain by an even thicker series of Pierre shale, which does not differ in any essential respect from the Lewis. The sandstone varies in thickness from less than 100 to more than 500 ft., but the best production has been obtained in areas where the Wall Creek is of moderate thickness. The Wall Creek is divided into a number of productive horizons—known in the oil fields as the First Wall Creek, Second Wall Creek, Third Wall Creek—by beds of shale which separate the sandstone beds from one another.

Even a brief examination will indicate that the situation in the San Juan Basin closely resembles that in Wyoming. At the base of the Mesaverde is a bed of sandstone nearly 200 ft. thick and sufficiently porous in most places to form a good storage horizon. A similar sandstone lies at the top of the Mesaverde immediately underneath the Lewis, and separated from the lower sandstone by a considerable thickness of shale. Even if no oil has migrated downward from the Lewis into the underlying sand, the shale serves as an adequate and impervious seal for the possible oil horizons below.

Enough oil has been found in the Mesaverde along the south side of the San Juan Basin to encourage further drilling. The Mancos shale may never have produced large quantities of oil, and the overlying sandstones may be barren, but until this has been conclusively proved by several tests drilled on good structures, I am inclined to regard the San Juan Basin as the best prospective oil territory in the State of New Mexico.

The Boulder, Col., Oil Field

Extensive Exploration of Old Petroleum District Planned—Improper Methods Caused Declining Production—Oil Is of Good Quality

SPECIAL CORRESPONDENCE

THE Boulder oil field, which in 1902 and 1903 was the scene of great activity, and the source of a considerable production during succeeding years, is to be extensively explored during the coming summer by some of the larger oil companies whose geologists have been studying the formations and the records of the old wells.

Oil was first struck in paying quantities in January, 1902, about three miles northwest of Boulder. Following this discovery, the usual excitement incident to the opening up of a new district is recorded. During the year over one hundred wells were sunk in various parts of the county, but most of them in the immediate vicinity of the first well. The wells brought in the first year were all small producers, probably none exceeding 20 bbl. per day.

Oil was struck at varying depths, ranging from a little less than 1,000 ft. to about 2,300 ft. The production the first year was 1,100 bbl. During the following years, until 1908, the production continued to increase. That year the output reached 75,000 bbl. Drilling was carried on extensively, but results seemed to indicate that the producing area was confined to a narrow strip extending parallel with the foothills and comprising a territory about three miles long and one mile wide.

The largest producing wells were found in the northern part of the field, some of them yielding over 100 bbl. daily and one over 200 bbl. daily for several years. Since 1908 there has been a gradual decrease in production, last year the output being less than 2,500 bbl.

Development of this oil field from the start was almost without exception conducted in a haphazard way, with absolutely no regard for the future life of the field. In the absence of legal requirements regarding the plugging or capping of abandoned wells, water was permitted to flood the oil measures, and gas escaped unrestrained, with the inevitable disastrous results.

The oil is of a high grade, with a paraffine base. Bulletin No. 265 of the U. S. Geological Survey says: "The quality of the petroleum from the Boulder field is superior to that of any west of the Mississippi River."

For some time the Midwest Refining Co. has been securing leases on acreage in and adjoining the old producing field, and the company has announced that it will begin sinking a well in the northern end of the old field.

It is the theory of the company's geologists that the oil hitherto produced in this district has been migratory from an undeveloped source. The records of early wells would indicate that this source might underlie the limestone strata encountered in previous wells at about 3,000 ft. It is the purpose of the Midwest company to sink through the limestone formation, where it is believed a more prolific source will be found.

North of the old field, the Frantz Corporation has leased over 3,000 acres in Townships One and Two, and its geologists estimate that the oil strata here will be encountered between 2,200 and 3,500 ft. Both tests to be made this summer are for the purpose of seeking the primary source of the oil found in the old field.

Evaporation of Crude Oil in the Mid-Continent Field*

The evaporation of crude oil causes one of the largest single losses to which the oil is subjected after it is taken from the ground. The few days during which crude oil is stored on the lease before being taken by the pipe line involves an aggregate loss per year from evaporation estimated at 122,100,000 gal. of gasoline in the Mid-Continent field alone. This has a value, at 22c. per gal., of $26,880,000 and represents about 3 per cent of the total gasoline produced in the United States from all fields and all sources.

Companies handling crude oil have always realized that losses take place, but the proportion lost under any given condition has not been even approximately known. Sporadic efforts have been made to determine this loss, but no co-ordinated results have been published. In order to gain some definite information as to the magnitude and the causes of these losses, this problem was taken up at the Bartlesville experimental station and at the San Francisco office of the Bureau of Mines. In a bulletin which will be published soon, the results of investigations at the Bartlesville station will be presented in detail.

*U. S. Bureau of Mines, "Reports of Investigations."

NEWS FROM THE OIL FIELDS

Gulf Production Disposes of Holdings in Somerset Field

Sales in Burkburnett District and Morgan's Point—North Extension of Homer, Louisiana, Field Indicated

From Our Special Correspondent

The Grayburg Oil Co., of San Antonio has obtained an option on all the holdings of the Gulf Production Co. in the Somerset field near San Antonio. The property consists of about five thousand acres in the heart of the field, and on which are twenty small producing wells. In addition, there are rigs, camp buildings and power plant. The consideration, it is stated, is about $500,000. The Grayburg Co. already has over fifty wells on its own ground in this field, making an average production of 10 bbl. daily.

The Texhoma Oil & Refining Co., of Wichita Falls, has filed an amendment to its charter increasing its capitalization from $3,000,000 to $6,000,000.

On the Texas Gulf Coast, a large well was brought in during the fourth week in June, the Morris-Phillips No. 4, at Hull, Liberty County, drilled jointly by the Texas and Gulf Production companies. It came in making an initial output of 4,000 bbl. daily from 2,550 ft.

Two large sales of property in the Burkburnett district have been made recently. The Montrose Oil and Refining Co., of Ft. Worth, has purchased the oil property of the Touman Oil Co., of Okla., in Block 96, Northwest Burkburnett field. There are eight producing wells on this land. A one-half interest in 23 acres in Block 18 was sold by H. P. Pennington to T. O. Shappel for $23,000. This tract is near the Borg-and-Maer well, about two miles south of the Kemp-Munger-Allen discovery well area.

It was announced in Houston that Howard Walker had disposed of his entire holdings in the Walker Oil and Refining Co. to Eastern interests. The refinery is at Morgan's Point, on the Houston Ship Channel, and is in operation. The officials of the company have made no formal statement of changes in ownership or policy. Walker has taken an option on 35 acres above Morgan's Point, and, it is stated, will commence the construction of a 1,500-bbl. refinery in July. This will treat Gulf Coast and Mexican crude oils and manufacture lubricating oils and asphalt.

In the Homer district, Louisiana, six wells were completed on June 25 on the Garrett lease, making a total initial production of 3,950 bbl. In addition to these a new well on the Smith land, two and one-half miles north of the lease, is reported making oil by swabbing. This indicates an important northerly extension of the Homer field.

Deep Drilling Near Old Gainesville Pool, Kentucky

From Our Special Correspondent

An unverified report is current among oil men here that an 800-bbl. well has been found at a depth of 1,900 ft. on the old Jake Moulder lease on the Warren-Allen County line three miles north of the Gainesville pool. This pool was abandoned a year ago after it had produced lavishly from a shallow depth, few of the wells being over 150 ft. deep. Recently the Swiss Oil Corp. began work there, announcing they would drill to considerable depth. Their operations, as usual, have been conducted in secrecy, with a high board wall built entirely around the drilling rig. It is understood they have been successful, one estimate placing the production of the new well at 840 bbl.

Well No. 13 on the George Sledge lease in Warren County has been completed and a test made showing it to be good for 120 bbl. a day. No. 6 on the Willoughby lease a half mile east of the Sledge wells has been completed at 435 ft., 13 ft. under the shale. The well filled nearly to the top, and is reported good for 200 bbl. a day.

In Allen County, Holder & Parker have completed No. 3 on the Brown lease, estimated to be equal to No. 2, which filled two tanks of 250 bbl. each in 48 hours, and is pumping 100 bbl. at the present time.

Peace River Field

From Our Special Correspondent

Following a visit of inspection by W. C. Goffat and Thomas A. Cain of Toronto, to the western properties of the Peace River Petroleums Ltd., it is reported that as a result of the progress made crude oil will be delivered to purchasing companies before the end of the season. At well No. 1 in Peace River town, the operation of enlarging the bore from 6 to 8 in. has progressed for over 1,000 ft. Everything is in readiness to begin drilling at well No. 2 situated 2½ miles below Tar Island. Three new drilling equipments will be operated at Hudson's Hope, the Upper Smoky, and the Lower Smoky. Applications have been received from two Alberta companies for a supply of 20,000 bbl. of crude oil per month. The plans of the directors include the production of both gas and gasoline as well as oil. It is estimated that there is at this time 20,000,000 cu.ft. of gas per day blowing out of the wells in the district and going to waste. As this gas is wet it is possible to separate the gasoline from the gas, leaving a burning gas suitable for light, heat and power purposes. It is proposed to undertake this work and in the meantime a casing-head plant will be installed.

Oil Shipments to Georgia To Be Inspected

From Our Special Correspondent

The Federal District Court has refused the Texas Co. an injunction to prohibit the State of Georgia from inspecting oil shipments and collecting fees on such inspections. It was held that inspection could not be made on shipments of oil to Georgia consumers when delivered in the original containers, but that the state could inspect, and charge, therefore, all shipments for indefinite storage or sold in other than the original packages. If the Supreme Court sustains this decision, the annual fees collectable by the state will be approximately $600,000.

Coast District of British Columbia To Be Drilled

From Our Special Correspondent

There is considerable prospecting for oil and drilling in the coast districts of British Columbia. The oil shales of the Queen Charlotte group of islands long have inclined many to the belief that oil exists there in commercial quantities. George Clothier, resident mining engineer, made a superficial examination two years ago and recommended that a specialist should be engaged to make an inspection and submit a report. Prior to that one or more Canadian geologists had been over some of the ground but their reports were more or less indecisive. A company was organized recently and drilling has commenced near Lawn Hill, Graham Island. It was closed down temporarily owing to labor trouble, but, no doubt, will be resumed as soon as conditions are more favorable. It is announced that a company has been incorporated at Ottawa, known as the British Controlled Oil Fields, Ltd., with a capital of $40,000,000, which will begin an investigation of various Canadian properties. British Columbia oil possibilities will be given attention, it being stated that expert oil engineers are being sent West to look into the conditions on Graham Island.

The Kamloops Natural Gas and Oil Co. has recently been incorporated to prospect and drill for oil in the Kamloops district of British Columbia. Its capitalization is $500,000. The purpose is to undertake the search for and development of possible oil and coal fields.

A commission is to be appointed by the Department of Labor and Industry of Mexico to study the oil problem in conjunction with a commission representing American interests, according to the New York Times. The recommendations of these bodies will probably provide an amicable settlement of the present difficulties.

COURT DECISIONS IN MINING CASES

By Wellington Gustin

MONTANA

Appeals Court Sustains Day and Finley

Judgment for Return of Properties Denied—Defendants Doing Important Development Work

The Circuit Court of Appeals, Ninth Circuit, has affirmed the judgment of the District Court of the United States in the suit brought by the McCaffreys against Harry L. Day, J. D. Finley and others for rescission of a mining contract. The bill alleged failure and refusal of Day to comply with the terms of the contract, and that such refusal by him was arbitrary and in bad faith. The trial court found for defendants, and plaintiffs appealed.

The contract related to the mining property consisting of the Heron lode mining claim, the Cabinet lode mining claim, the Galena lode mining claim and the Cabinet Mill site, situated on Callahan Creek, in the Troy mining district, Lincoln County, Mont. This property belonged to the Big Eight Mining Co., but during 1910 it was leased to R. C. McCaffrey by the company, with an option to purchase for $50,000, deeds therefor being deposited in escrow, to be delivered upon the payment of the purchase price.

McCaffrey was a prospector and miner, and began working the property under the lease, shipping a number of cars of lead and zinc ore. The McCaffreys opened negotiations, through Mr. Finley, vice-president of the Exchange National Bank of Spokane, Wash., with the Grasselli Chemical Co., for the advance of the $50,000 with which to make the purchase, and for development work. But it appears that defendant Day was preferred by Finley, for the reason that he was an experienced and competent mining man, as well as one of abundant means, and the contract sued upon resulted.

Day had been manager of the large Hercules mines. He went to examine the property, and regarded it as a good prospect and agreed with Finley to advance $50,000 to make the purchase, and $50,000 more for development of the mines. The McCaffreys made deeds passing the property from the Big Eight Mining Co. through them to Day and Finley, in the proportion of 51 per cent to Day, 14 per cent to Finley, retaining 35 per cent in themselves. There was an additional contract executed by the parties for the purpose of putting up the money for development. Day and Finley retained an option to purchase the McCaffrey interests, and it was provided that Day, or some person designated by him, should, at all times, have the general management and control of the property.

The McCaffreys insisted that this contract was an essential part of the consideration for the deeds from the McCaffreys, which failed in a material part by reason of Day's refusal "arbitrarily and in bad faith, and not in the exercise of his judgment or of any discretion conferred upon him by the agreement," to advance the money or to do anything required of him thereby, in consequence of which the McCaffreys should have the contract rescinded and reconveyance of the property.

The court found the evidence insufficient to show the contract was part of the consideration for the deeds and that Day acted in bad faith or arbitrarily. Proof shows both Finley and the McCaffreys insisted that he proceed promptly to install machinery and erect a mill. The court said the complete answer to such suggestions was that by the agreement the development and operation was left to the honest judgment of Day. And Day testified to important and necessary preliminary development work. To save heavy costs for the production of power, independently, for mill operation, he had made arrangements for electric power through a near-by friendly operator who had erected a plant costing $350,000. All these things were good and sufficient reason for any delay, and judgment in his favor was sustained.

COLORADO

Ward Recovers Possession of Calamity Lodes

Court Holds That Location Certificate of Nos. 2 and 8 May Be Perfected by Additional Certificate

In the various actions brought by A. H. Ward and another against Andrew Nylund and another, claiming location and ownership of Calamity Lode No. 2, situated in the Blue Creek mining district, in Mesa County, Col., the Supreme Court of Colorado has affirmed the judgment against defendants, who had ousted the plaintiffs and claimed ownership of the ground by location of their Sunrise lode. Dispute over Calamity Lode No. 8 and the Cracker Jack lode has been determined in favor of plaintiffs.

The defendants contended that the original location certificate of Ward and the other did not purport to tie the claim to any natural object or monument, and for such reason was void, and that the additional location certificate correcting the original did not cure the defect. In deciding the question, the Supreme Court of the state held that an imperfect certificate was not void, but that when it is amended it has full life, the amendment taking effect with the original.

WASHINGTON

Relocation Notice Must Cite Facts

Newport Mining Co. Wins Suit Against Bead Lake Gold-Copper Mining Co. — Abandoned Property Not Properly Relocated

The Supreme Court of Washington has affirmed judgment in favor of the Newport Mining Co. in its action against the Bead Lake Gold-Copper Mining Co. These parties were rival claimants to a tract of mining ground located in the Newport mining district, in Pend Oreille County, Wash. The former company claims the Snowbird mining claim, which overlaps to the extent of about three acres the Comstock Fraction lode mining claim, owned by the latter.

The Newport Mining Co. claimed the right to the disputed territory under a relocation notice dating from April 25, 1907, and through having held adverse possession, doing the annual assessment work for a period of more than eleven years. The rival company claimed under a location notice of prior date, and under an amended and relocation notice that had been issued under date of Oct. 24, 1914.

The court said that a location notice which fails to recite that the property is located as abandoned property does not comply with the statute requiring that, when quartz or lode mining claims are located as forfeited or abandoned property, the location certificates shall state if the whole or any part of the new location is located as abandoned property; and that such notice is therefore invalid and insufficient.

Both parties were at fault in this regard, and the Newport company's contention was upheld through its claim of adverse possession of eleven years.

OREGON

Powder River Gold Dredging Co. Again Denied Redress

For the third time the case of Thomas Bessler against the Powder River Gold Dredging Co. has been brought before the Supreme Court of Oregon and the judgment in favor of Bessler upheld.

Plaintiff brought this suit to recover possession of three acres of land, claiming title by having held adverse possession for ten years. In a supplemental complaint he alleged that since the commencement of the action the gold-dredging company wrongfully entered upon the land, dredged and mined therefrom all the gold deposits, and entirely destroyed the property. Damages of $15,000 were awarded Bessler.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Production Must Be Increased by Preventing Accidents

Standardized Methods Efficient—Accidents Prevent Regularity—Safety Inspection Saves

At the meeting of the National Safety Council in Chicago recently, Sidney J. Williams, secretary and chief engineer, addressed the Engineering Section on the subject "How Can We Increase Production?" He spoke in part as follows:

"Production depends primarily on two factors—machines and men. Production also requires materials and capital; but machines and men are the immediate producers. They and they only can increase or decrease production. The things that cause them to do the one or the other are the things that we must study.

"The basis of modern production, with respect to both machines and men, is standardization. But we do not stop with standardizing machine operations. We standardize also the operations of men. The motion study specialist determines the one best way to do a job, and we find that by following his method we not only increase production but we decrease fatigue. Anything which interferes with absolute regularity of operation is inefficient and uneconomical, and it is one of the chief functions of the engineer and the executive to hunt out these disturbing influences and eliminate them.

"The things which thus interfere with regular production are many and varied. Some of them are external to the plant itself—such as a war, or a nation-wide strike, or a railroad tie-up. The prevention of these is largely a function of government.

"Then there are catastrophes within the plant: a strike, a disabling fire, a break-down in the power plant. Everyone knows that it is the function of management to prevent such occurmences and that a management which does not in general prevent them cannot be permanently successful.

"Then there is a third group of apparently minor disturbances. A laborer pushing a truck strikes an uneven place in the floor, a casting falls off the top of the load, and a resulting chain of delays wastes twenty minutes of the shop's day. The up-to-date foreman realizes that when his laborers each lose twenty-five cents' worth of time a day it is up to him not to bawl them out for it but to find out what is wrong and correct it. The superintendent and higher executive officers also must supply what the foreman may lack in this regard.

"In machine operations it is even more obvious that regularity is the essence of modern production. The greater part of present losses is positively preventable through the use of simple and inexpensive automatic or semi-automatic devices for placing and removing the material. The fact is that, with comparatively few exceptions, even in the most efficient plants, we have not had time to study these little things—the castings falling off the truck, the material sticking to the punch press—causing in the aggregate a loss running undoubtedly into many millions of hours and many millions of dollars. Modern production is built absolutely on standardized regularity of operation, and anything which happens unexpectedly, whether it is a coal strike or a casting falling off the truck, or other accident, is bound to interfere with our regular program and therefore to cut down our production.

"Some of the 'accidents' which I have mentioned result in personal injury. From the standpoint of the man interested only in production, the accidents which happen to injure someone are no more and no less important than those which do not. It is true that from other standpoints the accidents causing personal injury are much more important. No engineer or executive living can afford to say 'I am not interested in accident prevention' unless he is willing to say 'I am not interested in efficiency.' Every accident is an indication that there is something wrong with men, methods, equipment, or material. Those which cause injury have for the engineer a peculiar importance, because they serve as danger signals to warn him of the inefficiency that is undermining his output.

"The manager of one of the largest paper mills included in the membership of the National Safety Council once said to me, 'Before we had a safety committee, every little while we would have to shut down our machines because of a belt breaking or something of that sort. Now our safety inspection catches these things before they happen, and we have no more shutdowns. Our safety work has more than paid for itself through the increase in production, aside from cutting down our compensation costs.'

"On the human value of safety, I leave each of you to judge for himself. The rough-shod methods of American industry a generation ago, which left a trail of human wreckage, were not only inhuman—they were inefficient. They and the men who stood for them are gone on the scrap heap, and will never return."

Six hundred graduates and undergraduates of the Missouri School of Mines entered active service during the great war, 38 per cent of them going across. Nine made the supreme sacrifice.

Handling Explosives Underground and in Open Pits

Misfires, Lightning Risk and Liquid Oxygen Discussed

An address on "Safe and Dangerous Practices in the Use and Care of Explosives Underground and in Open Pits," was made by S. P. Howell, explosives engineer, U. S. Bureau of Mines, at the second annual meeting of the Lake Superior Prevention of Accidents Conference, held at Duluth, Minn., on June 24.

Mr. Howell stated that accidents due to explosives are not frequent, but include a high fatality rate which is due to the fact that many accidents claim two or more victims. In setting forth some of the precautions to be observed in the storage, handling and use of explosives and blasting supplies, he dealt in particular with the following:

1. How should misfires be handled?
2. Accidents due to lightning setting off explosives.
3. Liquid oxygen explosives.

In addition, the necessity for well-ventilated storage magazines, situated at prescribed distances from buildings, roads and railroads; proper practice in transportation of explosives, and the correct manner of charging and firing blasts were emphasized.

The name, "liquid oxygen explosive," is applied to a mixture of carbonaceous and absorbent materials with liquid oxygen, and the whole partly enclosed in a heat-resisting cartridge. The carbonaceous material may be crude oil, petroleum, paraffin, charcoal, cork dust, coal dust, wood pulp and many other substances. All of the carbonaceous materials mentioned, except coal dust, crude oil, petroleum and paraffin, are also absorbing materials, but the most efficient material for its absorbing properties alone is diatomaceous earth (kieselguhr), and it is a non-combustible material.

Liquid oxygen is produced in a special apparatus, the units of which may be small, is transported in spherical shaped, double-wall containers, the space between the walls being a vacuum and the materials of construction of brass.

The Germans used liquid oxygen explosives extensively in non-gaseous coal mines, quarries, iron mines, as well as for destructive purposes in French steel plants, and installed equipment for the production of liquid oxygen at several Lorraine minette iron ore mines. In Bureau of Mines Technical Paper 243, "Development of Liquid Oxygen Explosives During the War," George S. Rice has reviewed the literature and the results of a number of tests made at the Pittsburgh Experiment Station.

Low Prices of Copper and Zinc Part of the General Post-War Trend

Recent declines in the prices of a few commodities are not to be regarded as isolated instances, but are part of a gradual and general movement that has been under way for a considerable time, the National Bank of Commerce in New York says in a discussion of current business conditions. The statement continues:

"It has generally been conceded that prices would ultimately seek a lower level than that maintained during the war and immediately thereafter. Such decline has always followed the overstimulation of commerce and industry produced by war. Under these circumstances, a downward price movement, if gradual and orderly, is to be welcomed, both as an evidence of the return of more orderly conditions and as a factor in accomplishing that return. Such a movement in the prices of basic commodities is now clearly evident. Sharp recent declines in a few commodities, however, are likely to cause the business public to lose sight of the fact that in a number of other commodities a gradual decline has been under way for a considerable time. The prices of copper and zinc have been at low levels ever since the armistice."

Ainsworth Mining Camp, B. C., Surveyed and Described

"Geology and Ore Deposits of Ainsworth Mining Camp" is the title of a well-illustrated report by S. J. Schofield, just issued by the Canadian Geological Survey. The area covered is about fifteen square miles, bounded by Woodbury Creek on the north, Coffee Creek on the south, Kootenay Lake on the east, and the contact between the sedimentary rocks and the Nelson granite on the west.

Despite poor transportation over tortuous trails and roads in the early days, this camp, since 1896, has produced more than 100,000,000 lb. of lead, 5,000,000 lb. of zinc, and 6,000,000 oz. of silver. Prior to 1909 the zinc was not only not saved but was considered detrimental to the ore.

Mr. Schofield finds two classes of ore deposits in the Ainsworth camp, namely, true fissure veins, and replacement deposits in limestone. Most of the silver-lead deposits are associated with the limestone bands in the Ainsworth and Slocan series, although some of the important mines are in the schists, and others are in quartzites. The ores consist of galena and zinc-blende, associated with pyrite, pyrrhotite, occasionally chalcopyrite, and, in the Highland, marcasite, in a gangue of calcite, siderite, quartz, and fluorite. The fissure veins and replacement deposits are held to be contemporaneous.

A colored geological map, a contour map on a scale of 2,000 ft. to the inch, and sixteen colored diagrams showing the underground workings and local geology are in a pocket at the end.

Developments in Lake Superior Copper Mining Practice

"The outstanding feature of the situation in the Michigan copper district is the fact that the market price of copper is insufficient to more than barely meet operating costs, leaving nothing with which to meet depletion, depreciation, etc., or to attempt a much needed program of mining development, exploration or new territory and improvement in mechanical equipment." This statement was made by Ocha Potter of the Calumet & Hecla Mining Co., in a paper read by him at the second annual Lake Superior Safety Conference, held at Duluth, Minn., on June 25.

A careful analysis of conditions, said Mr. Potter, leads to the inevitable conclusion that leaving aside the question of the decrease in the selling price of copper, the best chances for remaining a factor in the business of producing copper lie in the possibility of the economy and greater production due to improvement of underground methods.

The greatest improvement during the last ten years was the development of the so-called one-man drilling machine. The co-operation of the Calumet and Hecla underground organization and the Ingersoll-Rand Co. in 1911 and 1912 resulted in the almost complete abandonment of the use of reciprocating drills and solid drill steel, and the substitution therefor of the various types of the so-called hammer drills and hollow drill steel that has followed. Had the efficiency of the drilling machine runners been as low in 1918 as it was in 1912 with the old-type piston drill, approximately 3,000 more miners would have been required in the district in order to secure the production which was finally obtained. Stope miners of the Calumet and Hecla mines produced 11.42 tons per man per shift in 1912, at a cost of 35c. per ton for supplies and labor. In 1919, this same class of labor produced 26.29 tons per man per shift, at a cost of 34c. per ton, with an increase in wages and supplies of over 100 per cent.

The following is a brief summary of Copper Country methods with respect to drilling practice: Drilling machines are of the mounted hammer type, using water, and weighing from 125 to 150 lb.; hollow hexagon drill steel of ⅞-in. and one-inch diameter is almost universally used; bits are of the Carr type, either single or double; maximum length of drill steel varies from 10 ft. to 16 ft.; air pressure varies from 70 lb. to 100 lb.; most of the mines pipe water for drilling purposes directly to the machines, the water lines being laid with the air pipes; ammonia explosives are used almost entirely, and for stoping purposes 40 per cent to 45 per cent is most common. Some of the mines make a practice of using 60 per cent powder for drifting and shaft sinking

Haulage practice includes the use of trolley locomotives, rope haulage and storage battery locomotives. As far as practicable large cars have been adopted and these dump directly into the skip by means of air lifts.

The use of chute loading from stopes has become general with the adoption of larger cars. Mr. Potter states that probably 60 per cent of all ore hoisted at the present time in the district is loaded by means of some type of chute or high collar.

Several of the mechanical loaders now on the market have been tried out but with little success, owing to the fact that the limited tonnage available at any one level makes a large expensive machine impracticable, while the coarseness of the broken ore is such that the smaller types cannot handle it.

Slushers of various designs are being given an extensive trial and they appear to be successful in high, flat stopes, where the broken ore will not run freely to the level.

The practice of exercising close supervision over the drilling of the individual holes in the ordinary process of stoping has resulted in an increase in the average recovery of the rock mined and it is probable that better results may be obtained by a more rigid application of this method.

Contract prices and bonus requirements have been the subject of careful study and today practically all mining and tramming is done either on a contract or bonus system, the old Cornish fathom basis for stoping contracts being abandoned in favor of the ton. For drifting the foot of drift is, of course, the unit and for tramming, the pay is usually based on the number of cars filled.

It is an interesting observation that the fact that conditions in the copper industry are unsatisfactory, has led to a closer co-operation among the engineers and executives and this may prove somewhat of a blessing in disguise. There are enormous tonnages of low-grade copper rock just as there are of low-grade iron ore, which may some day be made available through an application of some of the methods now being evolved by the pressure of stern necessity.

Officials Start Federal Club in Washington

Over a hundred members of the Government service who are in responsible administrative and technical positions met on June 17 and perfected a tentative organization which is to be known as "The Federal Club." The purpose of the organization is to care for many of the general service problems which are common to several departments by facilitating interchange of views, and, where appropriate, by joint action. Franklin D. Roosevelt, Assistant Secretary of the Navy, and Democratic nominee for Vice-President, is the chairman of the temporary body and Dr. E. B. Rosa, chief physicist of the Bureau of Standards, is chairman of the committee on organization and constitution.

Among the problems suggested for the action of the club are: Classification and salaries of the technical services of the Government, and budget matters affecting the executives of the various bureaus.

Book Reviews

Sources of Industrial Potash in Western Australia. By Edward S. Simpson, I. H. Boas, and T. Blatchford. Western Australia Geological Survey, Bull. No. 77, 46 + VIII pages, 2 plates, 4 figures, 8¼ x 5½ in. Perth, 1919.

A definition of terms and a brief account of potash as a plant food and its minor uses is followed by a review of the pre-war sources of world supply. This discussion of well-known data is introductory to Part III, devoted to the sources of potash in Western Australia. Wood ashes, it is pointed out, constitute a potential source of considerable potash, but no recovery has yet been attempted. Pegmatite feldspars (microcline) are also abundant, and have a K_2O content of 10.65 to 12.56 per cent. A large deposit of glauconite occurs at Gingin, but its low content of K_2O (2 to 3 per cent) discourages its utilization. A rather unusual source of supply noted by the author consists of the minerals jarosite and natrojarosite, which occur in sufficient abundance to promise a commercial source of potash. The potash is rendered soluble by roasting, and the iron residue may be utilized as a pigment. Alunite and natroalunite are possible sources.

In Appendix I analyses are given of kelps found on the coast of Western Australia. Calculated on the basis of dry matter in the weeds, the potash content varies from 2.81 to 7.97 per cent being somewhat poorer in potash than American kelps and about equal to those in Scotland. The Australian kelps are, however, comparatively rich in iodine.

Appendix II is devoted to a description of the alunite deposits of Kanowna. The mineral occurs in horizontal or flatly-inclined veins, varying from mere threads to two feet in thickness. The potash content varies from 3.1 to 9.3 per cent. That the material is present in commercial quantities still remains to be demonstrated. O. B.

Final Report of the Munition Resources Commission, Canada. By Thomas Cantley, chairman. 7 x 10; cloth; pp. 260. Published by the Canadian government.

This commission was formed to enquire into the supply of raw materials in Canada required for the production of munitions of war, and the best methods of conserving them. The subjects covered include 25 pages on aluminum, 47 on manganese, 29 on molybdenum, and 60 on platinum. The chapter on aluminum is devoted to a description of the field work carried on in British Columbia, and is beautifully illustrated. No bauxite deposits have yet been discovered in Canada, but the work done shows attractive possibilities for the future. Chromium deposits in the Black Lake district of Quebec are described briefly. Magnesite deposits near Grenville, Que., offer attractive possibilities if developed. Canadian magnesite has a high lime content, but shippers can turn out a product containing 85 per cent $MgCO_3$ with less than 13 per cent CaO, which has been found to be satisfactory for furnace linings. The numerous manganese deposits are carefully described. The bog ores found in New Brunswick are of particular interest.

Canada was of considerable prominence as a producer of molybdenum during the war. In 1918 she produced about 15 per cent of the world's supply, as did Norway and Australia, the United States producing a little over 50 per cent. Deposits have been found in Ontario, Quebec, British Columbia, and Nova Scotia. The first two named are of most importance. The possibilities of British Columbia as a platinum producer are discussed in considerable detail, and those interested in this metal will find some of the remarks particularly illuminating. No important tungsten developments have been made since the publication of Dr. Walker's bulletin on the subject in 1909.

An appendix to the book contains an interesting article on the planning and cost of construction and operation of an electrolytic copper refinery with a capacity of 50,000 tons per year. This refinery was never built. The result of an investigation of Nicu steel is also given.

The commission has produced a highly creditable report. E. H. R.

The Magnesite Deposits of Bulong, Northeast Coolgardie Goldfield, by F. R. Feldtmann. Western Australia Geological Survey, Bull. No. 82. 38 + VIII pages, 7 figures, 2 maps, 8¼ x 5½ in. Perth, 1919.

In the introduction a brief history is given of developments in the magnesite deposits of Western Australia, where chief activity dates from 1913. A description of the properties and uses of magnesite is followed by a discussion of the magnesite deposits of other countries, but no reference is made to the deposits in the State of Washington, U. S. A. Australian production in 1917 included over 9,000 tons from New South Wales, and nearly 200 tons from Victoria. Small deposits exist in Queensland, Tasmania, and South Australia. Although magnesite occurs in several localities in Western Australia, particular study was given to that in the Bulong area.

The magnesite is associated with greenstones, porphyries, and breccias, and is confined chiefly to an area about 2¼ miles long and covering about 350 acres. The mineral occurs in serpentine in the form of irregular veins varying from mere threads to a maximum width of two feet. In certain decomposed areas the veins are sufficiently numerous to occupy a greater volume than the enclosing serpentine. Hand picking of the rock would probably be necessary. The magnesite is comparatively free of lime and contains moderate amounts of silica and iron.

Present development is confined to three quarries and several test pits. Total production from 1914 to the time of writing was about 1,344 tons. No attempt is made to estimate the extent of the deposits except the general statement that a large tonnage of material carrying 90 to 95 per cent magnesium carbonate evidently is present. O. B.

Technical Papers

Sand Dune Tunneling—A paper, "Tunneling in the Sand Dunes of the Belgian Coast," by Capt. H. Tatham, published in the *Bulletin of the Institution of Mining and Metallurgy* for May, 1920, (1, Finsbury Circus, London, E. C. 2) outlines the methods used by English army engineers during the war for the purpose of establishing numerous observation posts in the described sections. The dunes in which the excavations were made consisted of dry sand, so that although the actual excavating entailed little work, considerable care was required in timbering and otherwise keeping the workings open. The caisson method and the spiling system, both of which are described, do not differ greatly from methods in general use, but the description of the sinking of "elephant" shelters, or trench cupolas, includes some interesting differentiation from regular tunneling practice.

Mining Education — The Federal Board for Vocational Education, Washington, D.C., has issued Bulletin No. 38, 168 pages, entitled "General Mining" (free). More than a million men in the continental United States are employed in mines and quarries. Many of the jobs require specialized knowledge to secure the best results. This book is an interesting résumé of what is being done and what should be done to educate those who expect to make their living in the mining industry.

Assaying Chrome Ores and Brick—The American Society for Testing Materials, 1315 Spruce St., Philadelphia, has issued a "Report of Committee C-8 on Refractories," which contains the details of a tentative method for the ultimate chemical analysis of chrome ores and chrome brick. Criticisms of the method are invited.

Government Control Over Prices. By P. W. Garrett. Published as W. I. B. Price Bulletin No. 3, by the War Industries Board, Washington, D. C. Paper, pp. 834, 5½ x 9. This voluminous book sets forth the complete history of prices during the war. It will be chiefly of interest to statisticians and to students of the subject covered.

Mine Dust—The U. S. Bureau of Mines in its *Reports of Investigations* for May, issued a 7-page mimeographed pamphlet on the method of collecting and examining samples of dust-laden air from metal mines.

MEN YOU SHOULD KNOW ABOUT

J. Leonard Replogle, president of Replogle Steel Co., sailed for England on July 1.

E. R. Bennett, of the Tonopah, Nev., School of Mines, will spend the summer in professional work.

Bruce White is at the head of a geological party that will do oil work in central Montana this summer.

Geo. R. Koik, has been examining silver properties in the Lordsburg, N. M., dstrict for Arizona capitalists.

A. E. Fath has been assigned to oil and gas geologic work in the Lost Soldier and Ferris mountains of Wyoming.

Edwin E. Chase, of Chase & Sons, mining and geological engineers, Denver, Col., is in Wyoming on professional work.

Roy Hatch, mining man of Juneau, Alaska, has returned to Salt Lake City, Utah, after a four years' absence in the north.

George E. Easley, mining engineer, of La Paz, Bolivia, was in New York on June 26, on his way home to Lee Summit, Mo.

Bruce C. Yates, superintendent of the Homestake Mining Co., at Lead, S. D., is in New York City on company business.

John Kiddie, division superintendent of the Arizona Copper Co. has returned to Clifton, Ariz., much improved in health.

R. C. Wells, of the U. S. Geological Survey, will examine the deposits of natural soda in Western states during the summer.

C. E. Van Orstrand will devote the remainder of the summer to observing deep-well temperatures in the oil fields of various states.

A. E. Sargent, formerly superintendent of the Mogul Mining Co., Terry, S. D., has accepted the position of general superintendent of the Akron mines, White Pine, Col.

F. G. Cottrell, director of the Bureau of Mines, has been designated to succeed Van. H. Manning as a member of the Interdepartmental Defense Board of the Council of National Defense.

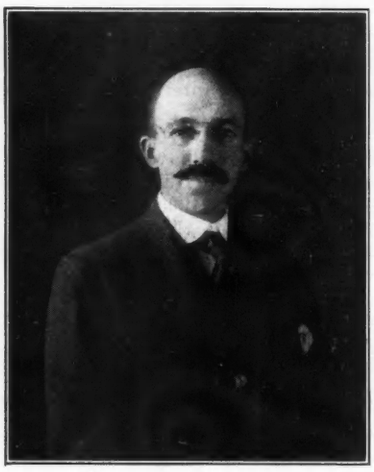
Lewis G. Westgate will spend two months studying the gold lodes recently discovered on the Alaska side of the international boundary in the Portland Canal region of southeastern Alaska.

Edward Sampson will continue **J. S. Diller's** work on the asbestos deposits of the Apache and San Carlos Indian reservations. Mr. Diller is now able to resume his office duties at Washington, D. C.

Charles Butts has returned from a field trip to the Appalachian valley, where he has been gathering paleontologic and stratigraphic data for the better correlation of the Mississippian and Devonian formations of eastern Kentucky.

Clive Seymour Newcomb, metallurgical engineer, has resigned his position with the Dorr Co., to become consulting engineer with the Mutual Chemical Company of America and the Phosphate Mining Co. His address is No. 55 John St., New York city.

George Otis Smith, director of the U. S. Geological Survey, has been given the honorary degree of LL.D. by his alma mater, Colby College, Waterville, Me. The degree was awarded in recognition of his services as Director of the U. S. Geological Survey.



ELMER ALLEN HOLBROOK

Elmer Allen Holbrook, who succeeds Dr. F. G. Cottrell as Assistant Director of the U. S. Bureau of Mines, is a native of Pittsfield, Mass., and a graduate in mining engineering of the Massachusetts Institute of Technology. Prior to his graduation in 1904 he worked in mines in Montana and was a member of one of the locals of the Western Federation of Miners. Mr. Holbrook's first position after leaving college was as sampler and underground surveyor with the Standard Ore Co. in Montana. After serving as superintendent at Zortman and at Gould, Mont., he was made general superintendent of the Daly Reduction Co., at Hedley, B. C., in 1907 when the Daly company was the largest gold producer in the Dominion of Canada. After three years with this company, Mr. Holbrook took up general practice and also for a time was in charge of the Mining Department of the Nova Scotia Technical College. In 1913 he became associate professor with the mining department of the University of Illinois and remained until 1917, when he was made supervising mining engineer of the U. S. Bureau of Mines in charge of the station at Urbana, Ill.

Mr. Holbrook was acting chief engineer of the Bureau of Mines during the first half of 1919. In July of that year he was made superintendent of the Pittsburgh Experiment Station, and had been in charge of that work until called to Washington to assume the duties of assistant director as of July 1.

Guy C. Riddell, consulting metallurgist, formerly in charge of metallurgical and mining problems for the U. S. Tariff Commission, is now secretary and consulting engineer of the Wah Chang Trading Corporation, 233 Broadway, New York, N. Y.

Alfred H. Brooks will accompany the Secretary of the Navy and the Secretary of the Interior on their Alaskan trip. Dr. Brooks will not return with the Secretarial party, but will remain in Alaska to do geologic work in the Prince William Sound region and in southeastern Alaska.

J. P. Buwalda, of the staff of the U. S. Geological Survey, has been assigned to the co-operative work with the Idaho State Bureau of Mines and Geology in the study of the Tertiary basins of the western part of that state. He will give particular attention to the areas more favorable for the occurrence of oil and gas.

F. H. Newell, head of the department of civil engineering, University of Illinois, Urbana, Ill., has been appointed director of field forces by the directors of American Association of Engineers. Dr. Newell is also delegate from A. A. E. to the Great Lakes-St. Lawrence-Tidewater Congress meeting at Detroit, Mich., July 22-24.

OBITUARY

Judd Stewart, of the accounting department, American Smelting & Refining Co., died July 3 in his 54th year, at Watkins Glen, N. Y.

John Albert Percival, a former president of the Consolidated Interstate-Callahan Mining Co., died suddenly of apoplexy at the home of Fred E. Stillman in Bridgeport, Conn., on July 4. Mr. Percival was a native of Jericho, Vt., and will be buried there.

Thomas Sneddon, superintendent of the Anaconda Copper Co.'s mines at Diamondville for the last 21 years, died suddenly from an aneurism at his home in Diamondville, Wyo., on June 3.

Mr. Sneddon was born 64 years ago in Scotland, and had been identified with coal mines about 54 years. Forty years ago, Mr. Sneddon brought his family to this country and settled at Almy, Wyo. In 1893 he went to Diamondville and in 1898, when the Anaconda Copper Mining Company bought out the Diamond Coal & Coke Company, Mr. Sneddon was kept on as mine foreman. He was made superintendent in 1899. Mr. Sneddon was a leader of men, fair and impartial in all his dealings and of unquestioned integrity. The Anaconda company has lost an official whose place it will be hard to fill.

THE MINING NEWS

LEADING EVENTS

U. S. Mining Experiment Station In Colorado Ousted

Action of State Officials Causes Indignation—Station May Be Moved To Nevada

The Golden Experiment Station of the Bureau of Mines has been forced to move from its quarters in the Colorado School of Mines by the action of the school board. No notice of the intention of the school to remove the station was given until a few weeks ago when the board paid a visit to Dr. Lind, superintendent of the station, and inspected the whole building. Dr. Lind states he thought it was simply a friendly official visit such as had never been made before. It was only on leaving that a member of the board intimated that they would probably need some of the space in the building for the new courses in chemical, electrical, mechanical and civil engineering which had been decided upon.

It seems that the Bureau of Mines had a contract with the school for the space which they occupied on the school grounds and that this contract expired July 1. Regarding the renewal of the contract, the school trustees took the stand outlined as follows:

Superintendent U. S. Bureau of Mines,
Golden, Col., June 11, 1920.

Dear Sir:

At a meeting of the board of trustees held this day, it was decided that the contract between the Bureau of Mines and the Colorado School of Mines would not be renewed with the inclusion of the use of Engineering Hall. We shall be very glad to renew the contract, offering you the use of our metallurgical research plant for your headquarters to be used in conjunction with the Metallurgical Research Department.

Prof. Low will confer with you and arrange the details so that the vacating of Engineering Hall will discommode you as little as possible.

Very truly yours,
I. A. PALMER, Acting President.

The contract which was sent over to Dr. Lind and which the board stated they would approve involved moving to the Experimental Mill, a building unsuited to the requirements of the station, and further specified that all work done by the Colorado Station of the Bureau of Mines would have to be done in Golden. It is believed that the latter clause was prompted through the jealousy of the School of Mines toward the University of Colorado, the institution at which the U. S. Bureau of Mines has been conducting its oil-shale investigations, fostered by appropriations made by Governor Shoup.

The U. S. Bureau of Mines at Washington, D. C., has decided to move the Colorado station, and the Colorado School of Mines officials, notably Dr. Alderson and the board, are being sharply criticised for their summary action. Colorado loses a valuable experiment station by this action—one that expends about $150,000 annually in the interests of mining research in the state, particularly in complex and rare ores. The station is being taken out of the State of Colorado entirely and will be moved to some other locality, where the work will be more welcome. It is very likely that Reno, Nev., will be the place of transfer. Reno has offered to float $30,000 of State Bonds in order to erect a building for the Nevada Bureau of Mines Station. It is a good location for the continuation of the rare-metal work initiated in Colorado.

The mining men of Colorado have resented the action of the School Board and severely condemned the body for the action which it has taken in forcing the Bureau elsewhere.

WEEKLY RÉSUMÉ

The Golden Station of the U. S. Bureau of Mines has been ousted by the action of officials of the Colorado School of Mines, and will be moved to another state. The American Bankers' Association, in a report just made, opposes the McFadden Gold bill as inimical to the gold standard. An investigation has disclosed that Salt Lake Valley smelter smoke is not a factor in the local smoke problem. The Desert Power & Water Co., of Kingman, Ariz., has asked for an increase in its rates on the plea of higher costs. A continued car shortage is hampering iron-ore shipments in the Lake Superior district. The Interstate Commerce Commission upholds freight rate increases that were contested by the Anaconda Copper Mining Co. and others. The War Department will furnish aeroplanes for Alaskan survey work by the U. S. G. S. Plans are being perfected for North Atlantic seaboard power survey. The progress of new mining legislation is outlined in this week's pages.

The bill now before the Ontario Legislature to amend the Workmen's Compensation Act, and which it is expected will pass, will raise the rates of compensation for injuries to 66⅔ per cent instead of 55 per cent as at present. Pensions will also be increased and in the case of widows will be made retroactive to the commencement of the present act. An attempt was made to have the retroactive feature apply to all pensions, but the labor members were unable to get this through.

Gold Miners' Bonus Opposed

American Bankers' Association Says McFadden Bill Would Menace Gold Standard

The McFadden gold bill has been studied by a committee appointed by the American Bankers' Association for that purpose, and a report made public expressing the unalterable opposition of the committee to the legislation favoring a bonus of $10 per ounce on newly mined gold. The committee consists of George M. Reynolds, Lawrence E. Sands, and A. Barton Hepburn, who state that one objection to the McFadden bill is the possibility of fraud being practiced upon the Government through the difficulty of distinguishing virgin gold from old gold melted down. "Gold which differs from other gold merely in having a special history, and which, by virtue of that special history rather than its intrinsic qualities, commands a high premium, presents an anomaly inconsistent with the normal functioning of a free gold market and the normal functioning of the gold standard. The temptation to manufacture history instead of mining gold would be very great.

"Again, the provisions in the McFadden bill introducing the index number of commodity prices as a basis for fixing the rate of taxes on gold manufacture and of premium on gold mining constitutes an opening wedge for the general introduction of the index number as a standard of value in the United States in accordance with Professor Irving Fisher's plan for 'stabilizing the dollar.' It is beyond the province of this paper to deal with that plan in extenso. Your committee believes in the gold standard and does not believe in tampering with it or interfering with it in the present critical condition of the world's monetary affairs. There is, moreover, another committee of the American Bankers' Association which is to make a detailed report upon the project. We shall content ourselves for the present with pointing out that if this index number standard is to be adopted it should be considered on its own merits and not introduced 'by the back door' as a feature of the McFadden bill.

"The greatest objection of all, however, lies in the danger which this measure would involve for the gold standard itself. Nearly all of the European states are on a paper basis. Only a few of the smaller countries of Europe are even approximately maintaining the gold standard. The United States, par excellence, and Japan as well, stand out conspicuously as nations

maintaining the gold standard. All the world believes that our dollars are as good as gold. All the other nations of the world are struggling and hoping to get back to the gold standard. We enjóy a proud pre-eminence in this respect, and it should be zealously guarded and maintained. The belief which obtains in the world today that our dollars are as good as gold must be maintained. The whole world must be convinced that money can be deposited in this country at any time and withdrawn at any time in any form which the depositor may elect.

"Increase of gold mining will return with normal conditions. It must not be forgotten, however, that part of the automatic working of the gold standard depends upon an increase in gold production when prices are low and upon a decrease in gold production when prices are high. Increased gold production in a period of low prices and low costs makes it easier for prices to rise again, while diminished gold production in periods of high prices and high costs tends to reduce prices and costs again.

"Moreover, the industrial consumption of gold tends to increase in a period of high prices, since the price of gold does not rise as other prices rise, while in a period of low prices the prices of gold manufactures are relatively high, and purchases of gold manufactures consequently tend to diminish. Variations in the consumption of gold thus also work toward diminishing the supply of free gold when prices are too high, and toward increasing the supply when prices are too low, thus tending to correct both the rise and the fall of prices. In this feature of gold production and consumption we have one of the stabilizing factors in the gold standard. The McFadden bill proposes to strike at this automatic regulator and corrective. It would aggravate the very conditions which it seeks to remedy."

Utah Deposits To Be Utilized for Paints

The Mineral Paint Products Co. has been organized and will take over the holdings and business of the Utah Wall Tint Co. Directors and officers of the new company are Michael Morrissey, president and general manager; Jacob Karlen, Jr., treasurer and vice-president; Canute Peterson, secretary and general manager. The capitalization of the company is $300,000, divided into 300,000 equal shares.

The new corporation will operate a four-story factory situated in North Salt Lake near the Utah Oil Refining Co. plant, and will secure their raw materials from the deposits of talc and red iron oxide near Clear Lake, Millard County. The talc is used in making calcimines, chalks and paints. The red oxide is used for making mineral paints. Both of these deposits, which are but a short distance from the Salt Lake & San Pedro railroads and which are easy of access, can be worked at a small expense on a large scale.

Smelter Smoke Diffused Before Reaching City

Engineers' Investigation Finds Smoke Nuisance Attributable to Local Causes and Not to Smelters

That smoke from Salt Lake Valley smelters is not a factor in the smoke problem, which confronts Salt Lake City in the winter months is announced by the U. S. Bureau of Mines, which, in co-operation with Osborn Monett, a fuel engineer of Chicago, has been investigating the smoke situation here. Smoke from the smelters is diffused before it reaches this city, and so the problem becomes a purely local one. The problem here differs from that in other places inasmuch as the topography of the region enters largely into the question. Smoke clouds are held fast in the valley between the mountains in the winter time, unable to escape owing to the low velocity of the wind at that season. Smoke from furnaces starting before daylight, and in most places dispelled in the early morning hours continues to hang over the city, when the smaller plants and household furnaces are starting up. The first step toward betterment recommended is the elimination, as far as possible, of this particular blanket of smoke,—by better firing methods, the elimination of out-of-date and run-down plants, and the introduction of smoke-reducing apparatus. The problem is largely one of education, and the investigators state that if their recommendations are followed the nuisance will be largely reduced in two years. The yearly cost of this work is estimated at $15,000.

Car Shortage Hampering Iron Ore Shipments

The coal situation in the Lake Superior districts is much better than it was, but the mine operators are proceeding cautiously in order that fuel may be conserved. The Oliver Iron Mining Co. stopped all stripping on the Mesabi range and is only operating those shovels which are working in ore. The ore loading is not going ahead very rapidly, due to the congestion at lower lake ports, and it is now certain that the 1920 shipments will be below the average. The chief difficulty is in moving ore from the Lake Erie docks to the furnaces, there being a shortage of cars, and likewise it is difficult to get coal from the mines to the lake ports. Vesselmen complain that they are frequently forced to wait for a week at some Lake Erie port before the boats are unloaded, as it is not the practice to place ore in stock at the docks at this season of the year. There are plenty of boats to take care of the ore that the mines desire to move, but shipments will not be increased until conditions are improved in the East. The operators have made large contracts for 1920 delivery which cannot be filled unless a change for the better takes place soon. Now is the time of the year when the lake fleet should be making its best record as many of the vessels will be diverted to the grain trade in the fall.

Power Company Seeks Permit To Charge Higher Rates

Increasing Difficulties in Securing Materials and High Costs of Operation Demand Adjustment

The Desert Power & Water Co. of Kingman, Ariz., has asked the Arizona Corporation Commission for a large increase in its rates. It has been charging the mines of Oatman, Chloride and other Mohave County camps 1.09c. per kw. hour and alleges that the present actual cost, with consideration of higher wages, increased cost of fuel oil and material, combined with depreciation, is not less than 3.3 cents. In Arizona considerable power for mining operations is secured from commercial electric lines. Jerome, Clarkdale and the districts near Prescott and Mayer and in the Bradshaw Mountains are served by the Arizona Power Co., which lately extended its lines to Phoenix past the Kay and other central Arizona mines. Its power has generation at two hydroelectric plants on Fossil Creek and in a large oil-fuel plant near Clarksdale. The Inspiration, at Miami, secures much power from the Roosevelt hydroelectric system, as does the Magma. Ray has its central power generating system at Hayden and Bisbee at Douglas, in connection with smelting plants. It is understood that the wires of the Southern Sierras Co. are to be extended from Yuma to Gila Bend and Ajo, to the New Cornelia works. Large power development is promised, possibly to the extent of 50,000 kw., in connection with the Verde River water conservation plans lately approved by the Interior Department. Power development of this sort is considered of large importance to mining industry in Arizona, owing to the rising difficulty in securing fuel for power at whatever cost.

Interstate-Callahan Purchases Coeur D'Alene Properties

John A. Percival, late president of the Consolidated Interstate-Callahan Mining Co., announced prior to his death on July 4 that the company has completed the purchase of controlling interest in the Chicago-Boston Mining Co. and the Killbuck Mining Company, both of which own large silver and lead properties in the Coeur D'Alene district, near Wallace, Idaho.

Officers and directors of the new additions will be chosen from the personnel of the Callahan company, and an aggressive development campaign is planned to place the properties on a production basis as soon as possible.

The Nevada Attorney General has rendered a decision to the effect that construction costs cannot be deducted from the gross income of mines in arriving at the net profits, for the purpose of levying taxes. Most of the heavier producers in the state have refused to pay their taxes on this basis and a test case is now before the courts in Nye County.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Interstate Commerce Commission Uphold Freight Rate Increases

Voluminous Opinion Rendered—Rates on Smelter Products from Washington and Idaho Unduly Prejudicial

With certain exceptions, the complaint of the Anaconda Copper Mining Co. and other corporations engaged in mining, concentrating and smelting copper, lead, zinc and other ores, against the all-rail and rail-and-water rates from numerous Western points of origin was not upheld by the Interstate Commerce Commission. A voluminous opinion in the case has just been handed down. The Commission found, however, that rates on smelter products from points in Washington and Idaho have been unduly prejudical. The same is true of the rates on smelter products from points in Arizona and Texas to Galveston, Texas. Reasonable rates were prescribed. The Commission also ruled that failure on the part of the carriers to establish a refining-in-transit arrangement at Baltimore, Md., was not unreasonable. In the course of its opinion, the Commission says:

"Complainants in the instant cases deny that the increased price was intended to cover the increases in transportation charges and claim reparation from the date when the increased rates were established. There are no figures of record which give the cost of producing a unit quantity of copper or other smelter product. In any event it must be presumed that the price-fixing activities of the government were fairly conducted, and the presumption is strengthened by the fact that there is no showing that the price fixed for copper did not cover the cost of production plus a reasonable profit. It may also be observed that while an increase of more than 25 per cent was imposed upon the bullion traffic, smelter products were not alone in taking increases, in many instances, of more than 25 per cent under General Order No. 28. Low-grade commodities such as coal and coke, moving for short distances, were subjected to increases of more than that percentage and the application of the provisions of the general order referred to resulted in increases of 80 to 100 per cent on sugar and more than 100 per cent on certain commodities of less value than bullion that move for substantial distances, notably corn, oats, rye and barley. Many other articles of commerce have been subjected to successive increases of 5, 15 and 25 per cent and complainants' argument that the bullion rates should not have been increased a greater percentage than were the rates on other commodities would lead logically to a holding that bullion should have been subjected at least to those successive increases instead of having been maintained on substantially the same level for more than 10 years."

In connection with the shipments of smelter products from Arizona and Texas points to Galveston, the Commission prescribes the following maximum rates:

To Galveston, Tex., from:

Hayden, Ariz.	$11.50
Miami, Ariz.	10.25
El Paso, Tex.	8.75
Eagle Pass., Tex.	7.00
Laredo, Tex.	7.00
Brownsville, Tex.	7.00

Another extract states:

"We are of opinion, and find, that under all the circumstances the maintenance of rates on smelter products, including pig lead and lead bullion, from points in the states of Washington and Idaho to points on and east of the Missouri and Mississippi Rivers higher than the rates contemporaneously maintained from points in Montana, Utah, and Arizona to the same points of destination was and is unduly prejudicial to such points in Washington and Idaho."

With regard to the matter of refining in transit, the Commission says:

"The evidence fails to show that the rates from points of origin to Baltimore, or on refined copper from Baltimore are or have been unreasonable. Reasonable routes now exist in connection with which transit services are accorded on the basis of the through rates, and in the absence of any violation of the requirements of the act to regulate commerce or the federal control act complainants' prayer for transit service at Baltimore must be denied."

War-Minerals Relief Awards

Awards recommended by the War Minerals Relief Commission during the week ended June 26 are as follows: (The name of the claimant, the mineral, the amount recommended and its percentage relationship to the amount claimed, are shown) Pillsbury, Crowder and Kay, chrome, $3,682.35, 66 per cent; James A. Drennan, chrome, $412, 49 per cent; A. C. Epperly, chrome, $496.86, 49 per cent; Helen Hildredth, chrome, $252, 88 per cent; Daniel Wilson, chrome, $265.20, 91 per cent; Franklin Mining Co., manganese, $2,074.44, 30 per cent; Elberg, Mills and Maine, chrome, $1,489.80, 41 per cent; Watson, Williams and Wadleigh, chrome, $1,682.92, 25 per cent; Olympic Smelters Co., manganese, $5,437.05, 21 per cent; Emily M. Pletz, chrome, $100, 100 per cent.

Government Aeroplanes For Alaskan Survey Work

In announcing a flight from New York City to Nome, Alaska, the War Department gives as one of the reasons for the utility of this expedition co-operation with the Geological Survey in the photographing of inaccessible areas in Alaska which have not been mapped heretofore. A paragraph from the War Department announcement is as follows:

One area in particular which the Geological Survey especially desires to have photographed from the air comprises 3,500 square miles, lying north of the 66th parallel between Fort Hamlin and Circle. This area includes the upper Yukon flats and is a district which can only be surveyed by ground methods with extreme difficulty. Representatives of the United States Geological Survey have estimated that it would cost as an absolute minimum over $10,000 and would take one surveying party at least three seasons which would mean three years to accomplish this work by the present ground methods and it would then only be partially accurate. Allowing for a 50 per cent overlap of the photographs from the air this area can be photographed from one airplane in ten hours of flying or approximately three days' time at a cost of about $1,500 and the data assembled from such a photographic map would be more accurate than could be obtained from the ground in the short time available each year.

North Atlantic Seaboard Power Survey

Plans are taking shape rapidly for the power survey of the North Atlantic seaboard between Boston and Washington, which is to be conducted by the United States Geological Survey. William S. Murray, of New York, has been appointed chairman of the engineering staff which is to make the investigation and the report. In addition to the engineering staff, there will be an advisory board. Professor L. P. Breckenridge, head of the Department of Mechanical Engineering of Yale University, will be chairman of the advisory board. E. G. Buckland, vice-president of the New York, New Haven and Hartford Railroad, and James H. McGraw, president of the McGraw-Hill Publishing Co., Inc., are the other members of the committee selected. Other appointments will be announced later.

In order to direct the work more effectively, the Geological Survey has opened New York offices which will be the headquarters of the engineering staff. The officers are in the Buckley-Newhall building at 709 Sixth Avenue.

Progress of New Mining Legislation

Bills of direct interest to the mining industry, which were enacted into law during the Sixty-sixth Congress, the second session of which recently adjourned, are as follows:

Mineral Leasing Act (Public Law No. 146); assessment work on mining claims suspended during 1919, Public Resolution No. 10; assessment work suspension extended to Alaska for 1919, Public Resolution No. 20; mining on Indian reservations, Public Law No. 3. In addition, there were a few laws enacted of minor interest, such as authorizing the detailing of medical officers of the Public Health Service to the Bureau of Mines; the sale of the mine rescue station site at Billings, Mont.; and legislation pertaining to Government fuel yards. Much important legislation of a mining nature is carried in the appropriation bills. These measures, which were duly enacted into law during the Congress, provided the funds with which the government work on mining subjects is conducted and provides for two new mine experiment stations.

While no great amount of mining legislation was enacted into law, numerous mining bills made progress along the tortuous legislative course. Since the recent adjournment did not mark the end of the Congress, but only of one of its component sessions, such progress as was made by these bills is retained.

The status of mining legislation, which was pending at the time of the adjournment, is as follows: Tariff on magnesite ores, passed the House, October 7, reported favorably to the Senate, March 2; Senate refused to consider, June 3; tungsten tariff, passed House, August 21, reported favorably to the Senate, March 23; zinc tariff, passed House, September 2, reported favorably to the Senate, April 9; War Minerals Relief Act liberalization bill, passed Senate, May 31, reported favorably to the House, March 25; mining for metalliferous metals on Indian reservations, reported favorably to the Senate, September 22; bill authorizing cutting of timber for mining purposes, by corporations organized in one state and operating in another, passed Senate, October 8, reported favorably to the House, April 30.

The trip of the Secretary of the Navy and the Secretary of the Interior to Alaska, while primarily for the purpose of looking into the coal situation, will include a visit to the metalliferous area centering at Fairbanks. The Bureau of Mines experiment station at that point will be visited. Despite the fact that the experiment station had to be closed for a time during the influenza epidemic, it will be able to show an extended record of work done on Alaskan mineral problems.

New California Assignment By Geological Survey

For a long time, there has been a demand for a geologist in the San Francisco branch office of the United States Geological Survey. Many requests for examinations and reports are received from the Pacific Coast which hardly justify the dispatch of a geologist from Washington across the continent. By having a geologist in the San Francisco office, more attention can be given to this class of requests. This need has been met by assigning J. M. Hill to the San Francisco office, where he will be associated with Charles G. Yale.

It is stated at the Geological Survey that no duplication of work being done by a state organization such as is the California State Mining Bureau will be permitted. The work will be carried on in full co-operation with the local organizations in the states in which Mr. Hill will work. It even is regarded as probable that the reports on field investigations will be turned over to the state mining bureaus or surveys for publication. This is in line with the publicity policy announced by the Director of the Survey in his last annual report, in which he said, "The guiding test in choosing the place of publication is where promptest issue and widest circulation can be given the results of federal scientific work. Publicity under the best auspices is the sole aim."

NEWS BY MINING DISTRICTS

ALASKA

Anchorage—The Gold Bullion Mine in the Willow Creek District has a crew of men engaged in the construction of a cyanide mill. It has been necessary to remove an excessive amount of snow preparatory to excavation work. The mill site is now excavated and the thickeners and agitating tanks are being placed.

ARIZONA

Bisbee—The new Copper Queen mill near Don Luis will have an ample water supply from a strike just made on the 1,700 level of the Calumet & Cochise at Warren, at a point 400 ft. southeast of the shaft that was sunk from the 1,000-ft. level for water. The flow has been bulkheaded till proper pumping provision has been made. The main pumping station will be on the 1,800-ft. level and is to be in operation by December 1. There also is to be drifting at depth in the hope of finding an orebody.

Calumet & Arizona will sink its Junction shaft down 500 ft. from the present 1,800-ft. level. The work, including concreting, installation of ore pockets on the several new levels and the cutting of stations, is expected to take two years. A heavy safety platform is to be placed at the 1,600-ft. level and below that depth there will be no mining until the completion of the new work. The deepest shafts in the district are the Junction 1,800, Denn 1,800, Sacramento 1,700, Oliver 1,600, Briggs 1,500 and Cole 1,400 ft. There is to be connection of the Junction and Denn on the 1,800-ft. level.

Hayden—Three trucks are hauling ore to the Hayden smelter from the Magma Chief property, formerly the old Sombrero Butte, in the Mammoth section on the San Pedro. The ore-testing plant of the University of Arizona at Tucson is engaged in the study of samples of Magma Chief ore, to determine methods for a mill the management is preparing to erect. Frank T. Pomeroy is in charge.

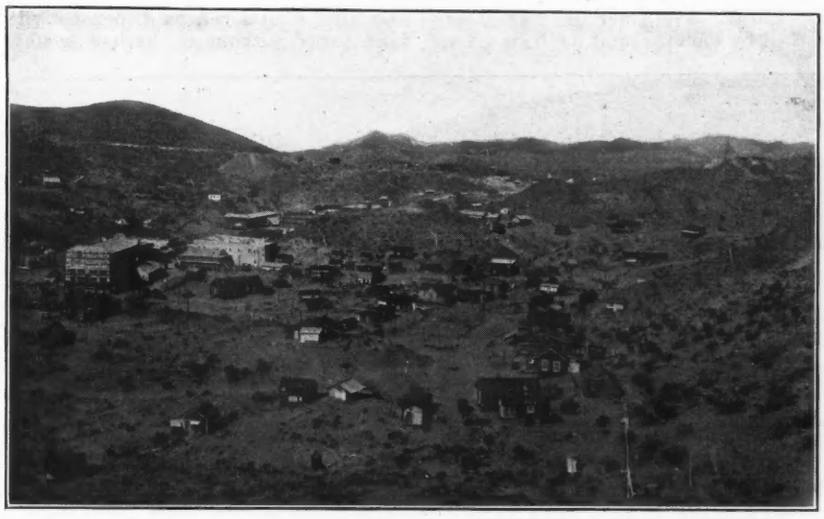
Wolverine has suspended work in new ground and is retimbering old workings, which are to be extended into proven ground. No ore has been shipped for ten months past.

Douglas—Peace in Mexico is having its effect upon the mining industry of Sonora. There now are being received at this port of entry about ten carloads a day of concentrates and ores. Two-thirds of the imports are from the Moctezuma Copper Co. of Nacozari, billed to the Phelps-Dodge smelter, though the Tigre is averaging nearly a carload a day. At Nacozari the Phelps-Dodge interests are spending about $1,000,000 in improvements on the Moctezuma reduction and power plants. The present 2,000-ton mill is being doubled in capacity. Seven new Diesels are being installed in the Nacozari power house to provide for the new demands. H. T. Hamilton is general manager at Nacozari and Frank Ayer is in charge at Pilares.

The North Tigre Leasing Co., operating the North Tigre mine in northern Sonora, has a new 50-ton mill in operation. Frank Holmes is manager and J. A. Hobbs in charge at the mine. In Ures district a cyanide mill is handling about 50 tons a day from the Progresso mine, a gold-silver property. A. McFarland is manager. One hundred men are employed. The Santa Barbara mines, near the Cananea railroad, again are being worked and two shipments of high-grade silver ore have been made to El Paso. The old Providencia silver mine, near the Sultana, is to be unwatered and worked, after years of idleness. W. R. Beatty, of Patagonia, has been placed in charge.

Johnson—The Mammoth, owned by the Arizona United Mining Co., is being equipped with a 40-hp. Western hoist and an Ingersoll-Rand compressor. The Keystone Copper Mining Co. have finished two large concrete tanks for water, to be used by the concentrator. This company has unwatered the O. K. shaft and started sinking. H. S. Wien, who recently took a lease on the old Hagin-Hearst property in the Winchester Mountains, twelve miles north of Johnson, is shipping a car a week of ore assaying twenty ounces in silver. The property has been closed down since 1885. The orebody recently struck in the Arizona-Texas still continues to increase in value, the last car shipped showing 50 per cent lead and 50 oz. in silver.

Oatman—United American is drifting east and west on the 500 level on the hanging wall of the Aztec ledge.



PART OF TOWN OF OATMAN, ARIZ., SHOWING MILLS IN BACKGROUND

Crosscutting from the shaft showed the vein to be about 38 ft. wide. West face is in 180 ft. with $15 milling ore showing the entire distance. Present face has considerable high-grade ore from which selected samples have run as high as $400. New east face just breaking into another shoot of good milling ore. Crosscutting to footwall from the west drift will be started soon.

Stockton Hill—C. O. D. shaft down 376 ft. on the vein, has opened up three feet of $45 rock. From this is being sorted a high grade of ore for test shipment. Raising on the vein is being continued north and south of the shaft from the 300 level. The 100-ton pilot mill will be in readiness for operation about October 1. New road to Berry, nine miles distant is completed. General progress underground somewhat handicapped by shortage of satisfactory labor.

The I. X. L. south drift on the 250 level is in high-grade shipping ore. This ore carries 200 oz. silver, 29 per cent lead, $2 gold with no zinc. Mine making about 10,000 gal. of water daily which is handled by jack head pump.

Duncan—It was the intention of the Ash Peak mine to contract for electric power from the Arizona Copper Co. at Clifton, a distance of about 18 miles. In view, however, of the fact that the latter have a deal pending that may mean eventually the taking over of their interests by the Phelps-Dodge Corp., the Ash Peak company declined to enter into any long-time power contracts at this time. As a consequence the American Smelting & Refining Co. did not exercise their option to purchase the property.

The Duncan Mining & Milling Co. are showing up some good orebodies recently encountered in their development work, and are working the mill steadily. J. S. Johnson, superintendent, has resigned.

The New Year's Gift group are contemplating building a 100-ton mill. Jesse Hardy is manager.

Patagonia — The Bachman-Merritt Metals Co. has purchased and is now operating the World's Fair mine. The mine is being unwatered and the new 150-ton concentration and flotation plant will be placed in operation as soon as possible.

CALIFORNIA

Grass Valley—The ten-stamp mill recently acquired by the Alcalde Mining Co. from the Golden Gate Exploration Co., has been transferred to its new location, and will soon be placed in commission. The plans of the Alcalde management is to increase the capacity of the mill to twenty stamps, in order to expedite underground developments that are planned.

Colorado operators have interested themselves in the Red Ledge mine in the Grass Valley district. They plan to explore the wide areas of country adjacent to the productive belt, and will also continue development of orebodies, already proven, to greater depth.

The Penn-California gravel mine has driven its tunnel to 1,300 ft. and it is expected that the main channel will be struck soon. A raise recently driven from the tunnel, opened up gravel deposits showing considerable gold values. A fifteen-stamp mill is on the property, and ample water for the working of the mill is available.

Jackson City—The consolidation of the Boston, Easy Bird and Mosher mines in the Mokelumne Hill district has been announced. It is reported that New York interests are responsible for the consolidation and that extensive developments are planned.

The de-watering of the Fremont Consolidated near Amador City is proceeding rapidly, and mining will soon be resumed. Plans are to sink the shaft deeper, and electric equipment has already been installed. The property was once a ranking producer of the Mother Lode, but for the past two years has been idle.

COLORADO

Telluride—The Smuggler-Union Mining Co. lost its new flotation mill at Pandora, three dwellings, a grocery store and several carloads of mine supplies, by a fire on June 24, which is believed to have started at a short-circuited switch in the mill. General Manager Bulkeley Wells was on the ground and so directed the efforts of the firefighters that the crushing plant and ball mill were saved. He estimates the total loss at about $150,000, covered by $120,000, and has already begun preparations to rebuild in the form of a concrete fireproof oil-flotation installation at an estimated cost of $250,000.

IDAHO

Coeur d'Alene District

Wallace—The Silver Triumph Mining company, near Hailey has found a body of ore 6 to 15 feet wide. A foot to two feet is solid galena containing high values in silver. The first samples contained $140 in silver and lead to the ton. The ore was disclosed in clearing an old cave, and has been found to a height of 70 feet above the upper tunnel and its dip indicates it can be found in a raise of 200 feet from the main tunnel. Three parallel veins lie in a zone 100 ft. wide.

The Bear Creek Mining Company, in the Cœur d'Alenes, is rapidly removing ore from its workings. The first carload of concentrates contained 61 per cent lead and six ounces of silver to the ton. Shipments will be made at the rate of a carload a week.

The Swastika Mining Company, in the Dixie camp of central Idaho, has widened its orebody from a fraction of an inch to six feet of good ore at a 150-foot point in the new drift. The major portion of the six feet of ore carries paying values.

Field parties from the State Bureau of Mines and Geology will be at work in many parts of the state this summer, according to Francis A. Thomson, dean of the school of mines at the University of Idaho, Moscow. Examination of ore deposits and the treatments of ore will be made.

The Montana-Idaho Copper Company, operating at Adair, has reached the

6,800-point in its drive into the mountain range. At this point the tunnel lacks less than 3,000 feet of its objective which is a point under the Monitor shaft. The mine is operating two shifts and advancing 9 to 10 feet a day. The tunnel is being driven outside of the vein. Ground is good and needs no timbering, although considerable timbering was done before this point was reached.

Kellogg — The Highland-Surprise Consolidated Mining Co. expects to be shipping again before the summer is over. The company has been idle for the past two years, but prior to that time had shipped concentrates that netted the company $78,435. There is a mill of 125-ton capacity and all necessary equipment for operation. A few men are now employed in the mine and this number will be increased as rapidly as conditions permit. The property is on Pine Creek.

ILLINOIS

Fairview—The Fairview Fluorspar & Lead Co. have almost completed the overhauling of their mill in which a number of changes in machinery and equipment have been made.

They are in the market for a 500- to 600-hp. Heine water tube boiler.

Cave in Rock—The Cave in Rock Fluorspar Co. has just sold and loaded out part of 700 tons of washed gravel fluorspar. The mine is located just outside the city limits of Cave in Rock and one-half mile from river loading point. Total cost to tow, haul and load this ore on cars is $1.75 per ton, which includes hauling from mine to river loading point. F. W. D. truck is now being used to haul from mine to river loading point.

The Spar Mountain Co. moved about sixteen thousand tons of ore from their works about five miles west of Cave in Rock, Ill. The ore occurs in a blanket formation and is from 3 to 15 ft. thick, outcropping on the surface.

MICHIGAN

Gogebic Range

Rains Impede Process of Open-Pit Operations

Heavy rains recently interrupted operations in the open pit of the Wakefield mine for a few days. Two of the steam shovels were drowned out and in places the water was about fifteen feet deep.

The Palms-Anvil mine between Bessemer and Wakefield has in the last year or two come to the front as one of the largest producers on the range. In May they established a new record for themselves, hoisting 103,000 tons.

At the Davis mine the shaft has reached the 26 level and the station is being cut out. This will be the bottom level and will be extended to intercept the orebody which is believed to follow down the dyke from the Newport mine. A considerable flow of water is expected, so a large pump house to accommodate four 400 gallon plunger pumps will be constructed on this level.

Menominee Range

Iron River—Cleveland-Cliffs Iron Co. has added a night shift at the Spies mine. One shift was inadequate to get out sufficient ore to meet the mine's contracts for 1920.

Escanaba—The Escanaba Iron Range Development Co. has discontinued drilling operations on its lands near Escanaba. Three holes were put down and the formation was cut, but no ore was encountered. It is believed by many that the Escanaba field is an extension of the Menominee range, but Wauceda, some miles away, is the nearest point to Escanaba where ore was found.

MINNESOTA

Cuyuna Range

Former Open-Pit Property Deepens Shaft and Employs Underground Methods

Cuyuna—The Rowe shaft at Riverton is being deepened 125 ft. from the present 220-ft. level and is now being worked by underground methods. Last year the milling system was employed and electric haulage replaced by the use of mules underground. Hoisting and pumping are done by steam. One hundred men are employed and shipments of 150,000 tons are scheduled for the year. Property is being operated by Pickands-Mather Co. for the Pittsburgh Steel Ore Co.

At the Sagamore pit at Riverton, a John A. Savage property, Winston-Dear and Co. are loading manganiferous ore with a dragline excavator. Shipments will be increased. The new drainage shaft to 150 ft. depth has been completed and is handling water in the pit. One shovel has started on pit clean-up.

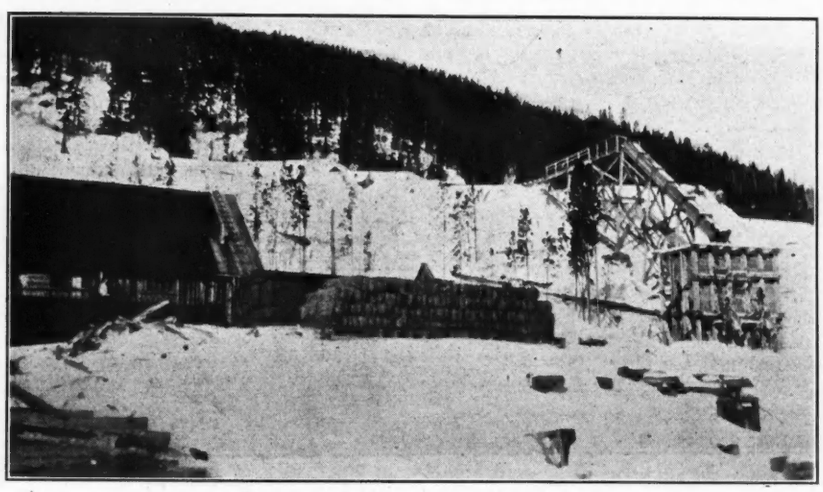
M. A. Hanna and Co. are shipping from the Cuyuna-Sultana stockpile at Ironton and expect to load the entire pile of 40,000 tons this season. The Hanna company had a lein on the ore against the Oneida Mines Co., the former operators. The property has been idle since the winter of 1918-1919 and the Oneida Mines Co. has been in serious financial difficulties.

The Northern Minnesota Ore Co. is pumping at the Northland mine north of Cuyuna. Bulkheads have lately been put in the drifts and the probabilities are that the drifts at least will be allowed to fill. The company is contemplating entering the Batesville manganese field, and has an option on a property east of Cushman, Ark.

MONTANA

Metal Trades Threaten Wage Advance —Anaconda Slightly Increases Production

Butte—Metal trades employed in the mines are threatening to demand a wage increase, but they are not extending the threat to the point of a strike, and labor leaders are of the opinion there will be no walkout. A year ago the metal trades struck, but lost their strike. Outside electricians may cause trouble, but the mines are well prepared to continue operations despite this craft, which is in a small minority and their efforts can be dispensed with for a period without any serious trouble resulting, and it is considered doubtful if any trouble at all would result of a character serious enough to embarrass mine operation. Butte gradually appears to be drifting toward the open shop, or the American plan as it is designated here. At the present time non-union mechanics are working alongside of union men and radicalism has received a decided setback. The I. W. W. are endeavoring to dispel their responsibility for the riot on Anaconda road last April, in which 16 men were wounded and one died from the wounds received, alleging that the persons who fired the shots were in the employ of the company. A suit for $125,400 has been brought by one of the wounded men against the company and in the case of the man who died it is stated in the application for letters of administration of the estate that the estate consists of an action against the murderers of the man. At the coroner's inquest nothing whatever was brought out to show who fired the shots, except that deputy sheriffs were present and some of them fired shots into the air.



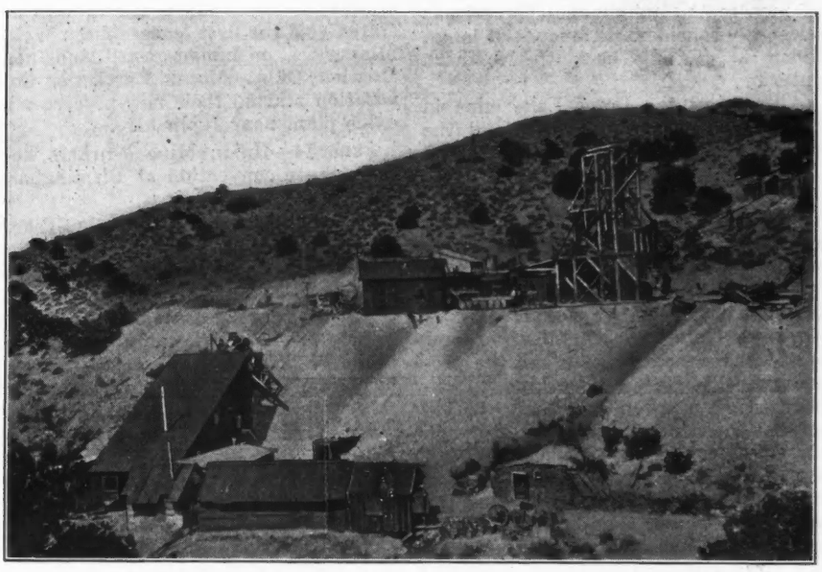
ORE CHUTE AND BINS AT BOSTON & MONTANA PROPERTY

Production of the Anaconda Copper Mining Company is being slightly increased, orders having been given to some of the mine foremen to spur up output somewhat. Washoe reduction works at Anaconda have been operating at a little more than one-third of capacity with the Boston and Montana plant at Great Falls, Mont., less than this. Labor situation as it pertains to miners is showing an improvement.

The group insurance plan started at the Elm Orlu, the first trial in the Butte district, is believed to be exercising a potent influence upon the miners, the Elm Orlu enjoying a larger shift comparatively than any other mine, despite its remote location from the city.

NEVADA

Mina—Jack Anderson has shipped by express 19 sacks of ore that carried 5,000 oz. of silver to the ton. This property, located on the south slope of Mount Mono, was discovered two years ago while he was prospecting on a grubstake furnished by Mrs. A. B. Crownore, assistant postmistress at Mina. They have refused a large amount of cash for the claims.



SIMON SILVER-LEAD MINE, MINA, NEV., SHOWING SHAFT EQUIPMENT AND EXPERIMENTAL FLOTATION PLANT

The Simon Contact mine has entered a body of ore in a crosscut from the 350-ft. level that carries values in silver and lead of $145 a ton. This shoot was also found on the 200-ft. level, but the values were not so high.

The Simon Silver-Lead Co. has found the ore on the 700-ft. level. It is claimed that between the fourth and sixth levels more than 500,000 tons of commercially profitable ore are now blocked out.

Austin—Last summer William Easton and J. B. Dinston located some claims in San Jean canyon of the Toyaba range, 30 miles south of Austin. Recently in running a tunnel, 160 ft. from the portal, a three-foot ledge was cut that carries 100 oz. of silver. This is a new district in which no mining has been done heretofore.

Arrowhead—Every day strikes of more or less importance are reported in this youngest Nevada silver camp. The latest and most sensational is that in a drift from the 100-ft. level of the Arrowhead mine, after going through 33 ft. of ore 3 ft. wide running 130 oz. to the ton, an 18-in. shoot was encountered that "goes as high as" 1,000 oz. in silver and 7 oz. in gold.

NEW MEXICO

Lordsburg—The Calumet & Arizona (85 branch) are sinking the main shaft 300 ft deeper which will give a total depth of 1,000 ft. below the zero level. Shipments are going forward regularly to Calumet & Arizona smelter at Douglas.

The Octo has commenced shaft work, sinking from the present 270-ft. depth to 300 ft. where crosscuts will be driven and the main shaft carried to 400 ft. at an early date. W. T. Bill and E. E. Forrester of El Centro, J. E. Davis of Long Beach and Geo. W. Foreman, of Los Angeles, Cal., all directors, visited the property recently. Fred C. Semmek is manager.

J. W. Jackson, formerly mine superintendent of the 85 mine, will continue to work his lease on the Superior claim of that property.

M. M. Crocker has a car of high grade silver ore ready for shipment from the Bonanza vein on the J. B. Foster property, which lies on the south side of the Bonney.

The Parks-Allen-Lurky silver property is under examination by Messrs. Koik and Wilson for Arizona interests.

Mogollon—Operations of the American Silver Corpn. have been unexpectedly suspended by orders from the eastern office. About two months ago this company took over the property and assets of the Socorro Mining & Milling Co., which had been in receivership, and commenced operations. D. B. Scott, general manager of the old company, continued in the same capacity with the American Silver Corp. The sudden shut-down came as a surprise and was followed by the resignation of Mr. Scott and the entire office force. Considerable difficulty had been experienced in building up a mining force on account of the inaccessibility of the camp.

SOUTH DAKOTA

Homestake Company Makes Changes in Hoisting Equipment

Lead—The Ellison hoist of the Homestake Mining Co. is being changed from steam to electric power. The cages will be replaced by skips. Room has been made for the new installations, but it is not expected that the new equipment will be in operation before 1921.

Hill City—The Golden Summit mine is being unwatered. Work has been started on the first level and will be extended to the other levels as soon as the water is lowered. The First National Gold Mining Co., with offices at Detroit, Mich., have taken an option on the property and the work is being done under their direction.

The National Tin Corp. have started the development of the Manitowac, which is near the concentrator and has railroad connections. The Cowboy has been closed down. At the Tin Boom the shaft has been sunk to 100 ft. and lateral work was started. The work at this mine has also been temporarily suspended. At the Mohawk, stoping has been started. The concentrator has again been placed in commission but the transportation facilities are such that the plant is operated at greatly reduced capacity.

Pringle—The Kirk quarries have been reopened under lease to Edward Manion. The limestone is shipped to the sugar refineries and a daily output of 100 tons will be maintained as soon as a full crew is obtained.

Deadwood—The Cutting Mining Co. have completed the sinking of the shaft to 500 ft. and lateral work is now under way.

The Echo Gold Mining Co. at Maitland have completed their shaft to a depth of 400 ft. and drifting has been started on this level.

UTAH

Juab County—Tintic shipments for the week ended June 26 amounted to 149 cars, as compared with 122 cars the week preceding.

The southern end of the Eureka Hill property, which is under lease to the recently organized Keystone Leasing Company is being opened through the adjoining Centennial Eureka, work starting from the 900 level of this mine. At the Plutus—now a part of the Chief Consolidated holdings—drifting is being done at a depth of 1,750 ft., starting from the winze sunk from the 1,000, where some time ago, mineralization was encountered warranting further work. Better ore is expected to be opened by deeper work. At the Chief itself, the new concrete-lined double-compartment shaft has reached the 1,400 level.

Bingham—Utah Consolidated will immediately begin work on the construction of a 1,000-ton milling plant to treat low-grade ores. For some time the company has been making experiments at a small mill leased for the purpose. The mill will be at Tooele, four miles distant, and the ore will be transported over the tramway at present in use. Recent development work is opening low-grade copper ore on the lower levels.

Toquerville—It is reported that control of the Silver Reef Consolidated Co., which owns the Silver Reef mines, has been secured by the Alvarado Mining & Milling Co.

WASHINGTON

Mining Activity in Okanogan County —Aerial Tram from Northwest Magnesite Co.

Nighthawk—There is considerable mining activity this summer in the Oroville-Nighthawk District of northern Okanogan County. At the Kaaba mine, a crew of men, under the direction of J. W. Douglas, are carrying on extensive development work on the vein in order to block out extensive reserves for future milling. The Four Metals Mining Company has deepened its shaft on the Alice claim to 150 ft. and on the Shamrock claim now has a shaft down 100 ft. and expects to soon encounter the vein on its dip.

Newport—The Bead Lake Mining Company has a crew of 20 men engaged in the construction of a 100-ton mill. The company is operating its own sawmill to supply lumber for the construction work.

Boundary—The Electric Point Mining Company reported that it has opened a new chimney of high-grade galena. The new ore is located just on the line between the Electric Point and Gladstone mines, it was encountered in a drift from the 150 ft. level of the Electric Point workings.

Chewelah—The Northwest Magnesite Company, at Chewelah, Stevens County, is building six miles more of aerial tram, adding approximately $100,000 to the million-dollar plant now producing 8,000 tons of calcined product monthly.

CANADA

British Columbia

Low-Grade Prospects in Salmon River District To Be Diamond Drilled— Placer Miners Active in Cariboo

Stewart—Contract diamond drilling has been commenced by Boyle Bros. on the Province claim of the Big Missouri group. Last year the same form of development took place on the E Pluribus claim of the same group. This property is one of the most extensive of the low-grade prospects of the Salmon River section, Portland Canal district.

Col. T. A. Hiam, the representative at Stewart of Sir Donald Mann, expects the Northwestern Railway up the Bear River to be in operation this season. The bridges and right-of-way are being repaired and the gasoline locomotive to be used has arrived. As there are a number of properties up the valley to be developed, Col. Hiam is confident that the road will be kept very busy.

Alice Arm—The Taylor Engineering Co. is reported to have awarded a contract for the installation at the Dolly Varden Mine of a hydro-electric power plant. The cost is said to be $65,000.

Hazelton—The Kitselas Mountain Copper Co.'s concentrator at Usk has been successfully operated since early in June.

Ontario

Cobalt—The Nipissing has declared a dividend of five per cent payable July 20, to shareholders of record as of June 20.

The past few weeks have shown a decided improvement in the labor situation in Cobalt. Men are coming in from many districts and there is now no trouble in getting sufficient labor. Closing down of the big Chippewa power project at Niagara Falls, and laying off men in the automobile centers, has released a considerable amount of labor, which is drifting back to Northern Ontario.

All men at the Dome Lake mine in Porcupine have been laid off and the mine is being allowed to fill with water.

The Miracle mine near Porcupine plans several thousand feet of diamond drilling this summer. The property was developed and financed by a group of spiritualists.

The Kirkland Lake camp is showing more activity than any other part of Northern Ontario. A number of new operations are starting up and the producing properties are working to capacity. Excavation has been started for the Ontario Kirkland mill although the machinery has not yet been ordered. Development on the 400 foot level is stated to be very satisfactory and the oreshoot is longer than on the 300 foot level. The Lake Shore is sinking a new three compartment shaft to the 800 foot level and cutting stations every 200 feet. The Wright-Hargraves is suffering from a shortage of power and is carrying on mining operations by steam. The machinery for the mill is on the ground and construction is proceeding. The Granby Kirkland and the Chapat Hughes have both started development near Gull Lake and the Munroe Kirkland has started work to the North. Development on the Bidgood is stated to be very satisfactory and in the immediate vicinity, the Wood Kirkland and Lebel Oro have started work.

Manitoba

Herb Lake—Work on the Rex which had been discontinued since the fall of 1918 has been resumed.

At the Bingo a shaft is being sunk in the center of a mineralized belt 60 ft. wide, containing five veins. Rich ore, showing free gold, is being taken out and stored for treatment at the Rex mill.

CHRONOLOGY OF MINING

June, 1920

June 1.—Calumet & Arizona Mining Co. formally took over the Eighty-five mine at Lordsburg, N. M.—Senate amended the War Minerals Relief Act by conferring jurisdiction on the Court of Claims; this failed to pass the House of Representatives.—Judge Bourquin dismissed the Minerals Separation, Ltd., proceedings against Butte & Superior Co. for contempt, in the U. S. District Court at Butte, Mont.

June 7—Miami Copper Co. cited before the U. S. District Court at Wilmington, Del., to answer contempt charges brought by Minerals Separation, Ltd.

June 10—Secretary of the Interior promulgated regulations for operating in oil lands under the "Land Leasing Law."

June 11—Conference of State and Public Utility officials at Washington approved the resolution adopted by the National Committee on Natural Gas Conservation.

June 12—Secretary of the Interior declared void the first leases of the Welch Mining Co., on Indian-owned lands near Douthat, Okla.—Metals Extraction Corporation started their new-process zinc oxide plant near Joplin, Mo.

June 14—Union Mine Workers held their State convention at Birmingham, Ala.

June 15—Hearing of Minerals Separation, Ltd., contempt proceedings against Miami Copper Co. at Philadelphia, Pa.

June 16—Third sale of Choctaw and Chickasaw coal and asphalt deposits.

June 18—U. S. Circuit Court of Appeals, Philadelphia, Pa., denied petition by Miami Copper Co. to re-open its case with Minerals Separation, Ltd., in order to admit new evidence.

June 19—The Salt Lake Valley smelters raised their week-long embargo on shipments of certain kinds of ores.

June 23—Lake Superior Prevention of Accidents Conference opened at Duluth, Minn.

June 24—Mason Valley smelter-rates hearing began before the Interstate Commerce Commission at Reno, Nev.—Smuggler-Union Mining Co.'s new flotation mill at Pandora, Col., destroyed by fire.—Leading zinc mine operators met at Miami, Okla., and decided on a two-weeks' shut down of the leading zinc ore mines of the Kansas-Missouri-Oklahoma district, beginning June 26.—"Midsummer Day" celebrations among the Gogebic range miners caused most of the mines there to close on this day.

June 26—Kansas-Missouri-Oklahoma zinc mines shut down until July 10.

Recent Production Reports

Chile Copper produced 10,300,000 lb. copper in May against 8,172,000 in April.

Granby Con. M. S. & P. Co. produced 2,131,219 lb. copper in May against 2,105,400 in April.

THE MARKET REPORT

Published in part in San Francisco and mailed from there to our Western subscribers as a special service without charge pending the arrival of the *Engineering and Mining Journal*

Silver and Sterling Exchange

July	Sterling Exchange	Silver			July	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
1	394	99½	90½	...	5	....	....	..	52
2	395	99½	89¾	51⅛	6	393	99½	90	51½
3	394½	99½	89⅝	51⅛	7	393½	99½	91⅞	52½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

On the authority of the Secretary of the Treasury, we quote 100c. per oz. for silver, 1,000 fine, delivered at the option of the Director of the Mint to the New York Assay Office or to the mints in Philadelphia, Denver, or San Francisco, and proved to the satisfaction of the Treasury Department to have been mined, smelted, and refined in the United States. This quotation is retroactive to May 13.

Daily Prices of Metals in New York

July	Copper	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
1	18.20	46.00	49.00	8.25	8.10	7.60
2	18.35	46.75	50.00	8.10	8 00	7.60
3	18.35	46.75	50.00	8.10	8.00	7.65
5	.....	.....	.....	....	....	....
6	18.50	45.50	48.25	8.10	8.00	7.75
7	18.60	45 50	48.00	8.10	8.00	7 70

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for prompt and nearby deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point. All prices are in cents per pound.

Copper is commonly sold on terms "delivered," which means that the seller pays the freight from refinery to buyer's destination. The delivery cost varies, and it would be confusing to figure net prices on individual transactions. Consequently, an average deduction is made from the "delivered" price. At present the average cost of delivery from New York refineries is 0.15c. per lb., and that deduction is made to arrive at the New York price. When copper is sold f.o.b. or f.a.s. New York, of course no deduction is made.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

July	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
1	87	89½	103	249½	254	34½	35	41½	43¼
2	89¾	91¾	105	260	264	35¼	35¾	43¾	45¼
3	....	....	...	....	....	...	..	....	...
5	88¼	90¼	105	250½	256	34½	35½	44	45¼
6	87	89¼	105	246½	253½	34¼	35¼	42½	43¾
7	87¼	89½	105	247½	255	33¼	34½	41¾	43

The above table gives the closing quotations on the London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb.

Metal Markets

New York, July 7, 1920

Business continues of small volume, though with a firm undertone. The week-end holiday depressed sales considerably, almost no metal being sold on Friday or Saturday. Yesterday and today inquiries have been more numerous, but current industrial conditions prevent consumers from contracting for large lots of any kind of metal. The railroad situation continues gradually to improve, but prompt shipment does not yet mean delivery within any reasonable time in the majority of cases. Mexican conditions under the new government are reported improved.

Copper

The long-awaited buying movement does not yet seem to have begun, the large producers reporting only the usual insignificant sales, as has been the case for two or three months. The amount of metal in the hands of outside interests has dwindled considerably, and nothing is now heard of the Japanese copper which was offered at low prices two or three weeks ago. The price has therefore shown a pronounced tendency to approach that asked by the large interests, and almost nothing can be had at less than 18¾c., delivered. It is improbable that any buying movement as large as that of the early spring will occur. Rather, under present uncertain conditions, consumers are likely to buy comparatively small lots and more often. Nothing new is taking place in the export market, as far as can be learned.

Lead

The demand for lead for July delivery or shipment which existed last week, and, in conjunction with an improved London market, caused a rather sharp rise here, seems to have died down, and practically all the metal sold since last Wednesday has been for August delivery. Spot metal still commands a premium, as little is on the market. On the other hand, consumers are, in general, well supplied for current requirements. Lead for late July and early August delivery can be obtained at the prices which we quote, and late August metal at slightly under our prices.

The scarcity of prompt lead in the West and Middle West, the reduced production in that section, and the fact that New York is now a port of entry for Mexican lead, combine to bring the New York price approximately to the same figure as that quoted for St. Louis. In fact, it is not impossible for the New York price to fall even below that quoted for Middle Western delivery.

Consumption continues good, paint and storage-battery makers using large quantities.

Zinc

Prices continued to trend firmer during the last week, although little buying took place. A considerable amount of cheap spelter found its way into strong hands recently, when the price was less than 7½c., and it is unlikely that this will be unloaded at less than 8c. The fact that production has been curtailed at the mines will have a bullish influence, and, also, conditions in Europe seem to be somewhat improved.

Tin

Tin has been absolutely dead the past week. When the London market advanced on Thursday and Friday, some inquiries developed on the part of consumers who did not wish to have the price get away from them. The European market has again weakened, however, so that prospective buyers feel that they can wait a while longer. Quotations are nominal. Banca tin continues to be sold at a marked reduction over the price for Straits, the difference being about 1c.

Straits tin for future delivery: July 1st, 47⅛@48c.; 2d, 48¾@49c.; 3d, 49@49¼c.; 6th, 47@47¼c.; 7th, 48c.

Arrivals of tin in long tons: Total for June, 4,730. July 1st, Hongkong, 125; 6th, Liverpool, 65; London, 165.

Silver

The London market has been comparatively steady but quiet over the holiday period. Limited supplies from the Continent seem to be sufficient so far to satisfy the requirements of the London market. It is an open question whether the supplies will continue to meet the English demand, and there does not yet seem to be any way of developing that fact. The Continental accumulations are in large part in the hands of the peasants, and it would take time to gather in the hoardings in quantity.

Mexican Dollars—July 1, 67⅞; 2d, 67⅛; 3d, 67⅛; 5th, holiday; 6th, 67⅞; 7th, 69½.

Gold

Gold in London on July 1st, 2d, and 5th, 104s.; 6th and 7th, 104s. 1d.

Foreign Exchange

Price changes were narrow again during the last week, no fluctuations of any moment taking place, though sterling has been slightly weaker. In units to the dollar, francs were quoted on Tuesday at 11.70 and lire at 16.20. German marks were 2.63c. New York funds in Montreal were quoted at $130.87 premium per $1,000.

Other Metals

Aluminum—Ingot, 33c. per lb., with 32@32½c. open market for 98@99 per cent virgin; unchanged.

Antimony—Market continues weak. Spot, 7½c. per lb.; Cookson's "C" grade, 16@17c. Chinese and Japanese brands, 7½c. W. C. C. brand, 8½c.

[1]**Antimony, Needle**—Chinese needle antimony, lump, firm at 9½c. per lb. Standard powdered needle antimony (200 mesh), 12 to 15c. per lb.

Bismuth—$2.70 per lb., 500-lb. lots. Market quiet.

Cadmium—Nominal, $1.40@$1.50 per lb. Unchanged.

[1]**Cerium Metal** — Ingot form, $8@$9 per lb.

Cobalt—Metal, $2.50 to $3 per lb., black oxide, $2 per lb.

Iridium—Nominal, $300 per oz. No business.

Magnesium—Crude, 99 per cent or over pure, $1.75 per lb., for the metal in 100 lb. lots and over, f.o.b. Niagara Falls.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Ingot, 43c.; shot, 43c.; electrolytic, 45c.; Monel metal, shot, 35c.; blocks, 35c., and ingots, 38c. per lb.

Osmium—Open market, $50@$75 per troy oz.

Palladium—$75@$80 per oz.

Platinum—Market weak at $80@$85 per oz.

Quicksilver — Market weaker; $90@$92 per 75-lb. flask. San Francisco wires $85. Firm.

Ruthenium—$200@$220 per troy oz.

[1]**Selenium**, black, powdered, amorphous, 99.5 per cent pure, $1.75@$2 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $18@$20 per lb.

Metallic Ores

Bauxite—Unchanged from last issue.

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a minimum of 6 per cent silica, 72@80c. per unit, New York. California concentrates, 50 per cent Cr_2O_3 and upward, 60@65c. per unit, f.o.b. mines.

Iron Ores—Lake Superior ores, per ton, delivered at Lower Lake ports: Old Range bessemer, $7.45; Old Range non-bessemer, $6.70; Mesabi bessemer, $7.20; Mesabi non-bessemer, $6.55. Shipping condition is getting serious with respect to ores, but coal conditions are improving.

Manganese Ore—85@90c. per unit, 50 per cent Mn content, c.i.f. Atlantic seaport; chemical ore (MnO_2) $75@$85 per gross ton.

Molybdenum—85 per cent MoS_2, 85c. per lb. of contained sulphide.

[1]**Tantalum Ore**, guaranteed minimum 60 per cent tantalic acid, 65@70c. per lb. in ton lots.

Titanium Ores—Ilmenite, 52 per cent TiO_2, 2c. per lb. for ore. Rutile, 95 per cent TiO_2, 20@25c. per lb. for ore, with concessions on large lots or running contracts.

Tungsten Ore—Scheelite, 60 per cent WO_3 and over, per unit of WO_3, $7 f.o.b. mines; wolframite, 60 per cent WO_3 and over, per unit of WO_3, $6.50@$7.50 f.o.b. mines.

Uranium Ore (Carnotite)—$2.75@$3 per lb. for 96 per cent of the contained oxide (U_3O_8). Ores must contain a minimum of 2 per cent U_3O_8.

Vanadium Ore—$1 to $2.50 per lb. of metallic vanadium content.

Zircon—Washed, iron free, 10c. per lb. Zirkite—$90@$100 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., July 3—Zinc blende, per ton, high $48.90; basis 60 per cent zinc, premium, $46; Prime Western, $45; fines and slimes $45@$40; calamine, basis 40 per cent zinc, $36. Average settling prices: Blende, $42.87; calamine, $36; all zinc ores, $42.62.

Lead, high, $101.35; basis 80 per cent lead, $100@$90; average settling prices, all grades of lead, $100.73 per ton.

Shipments for the week: Blende, 10,919; calamine, 387; lead, 1,634 tons. Value, all ores the week, $646,650.

The mine close-down may be considered complete. Sellers claim the production is lessened 95 per cent and buyers concede 85 per cent. In thirty years' endeavor to get together on a proposition this is the first time over 50 per cent have complied. Most sellers have sold on the market, but a few are withholding ore. One company has 15,000 tons holding since the price declined below $60, and one company has 600 tons holding since the price dropped under $65 per ton. Outside these two lots the unsold ore aggregates approximately 6,000 tons, most of it simply withheld. Salable ore is about cleaned up. Cars were a little easier and the shipment was increased. The purchase this week was under 3,500 tons.

Platteville, Wis., July 3—Blende, basis 60 per cent zinc, $48 per ton for high-grade. Lead ore, basis 80 per cent lead, $90 per ton. Shipments for the week: blende, 1,454; calamine, 60; lead, 40; sulphur ore, 45 tons. Shipments for the year: blende, 36,027; calamine, 2,240; lead, 3,334, sulphur ore, 988 tons. Shipped during week to separating plants, 2,997 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,800@$2,500; No. 2, $1,100@$1,500; spinning fibres, $400@$700; magnesia and compressed sheet fibres, $300@$400; shingle stock, $100@$150; paper stock, $60@$80; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as Canadian royalty export sales tax. Freight rate from mines to Sherbrooke, Quebec, over Quebec Central R.R., 20c. per cwt.; from Sherbrooke to New York, 27½c., carload lots; freight to New York for crude No. 1, f.o.b. Thetford mines, $8.45 per ton, carload lots.

Barytes — Crude, 88 to 94 per cent barium content, $8@$10 per net ton; ground (white) $22@$25 in bags, carload lots; (off-color) $18@$20 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, $12 per gross ton; ground (white) $23@$25; ground (off color) $16@$19 per net ton, f.o.b. Cartersville, Ga. Crude, 88 to 94 per cent, $23; ground (white) $40.50; ground (off color) $27 per net ton, less than carload lots, f.o.b. New York. Crude, not less than 98 per cent, $11@$11.25 per ton, f.o.b. cars, Missouri; floated, $28 per ton in bbls.; $26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—Domestic, extra light, 5@6c. per lb.; light, 4½@5½c.; heavy, 4@5c; English, extra light, 5@7c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin) — Crude, $9@$12; washed, $12@$15; powdered, $18@$22; bags extra; per net ton, f.o.b. mines, Georgia; crude, $8@$12; ground, $15@$40, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $25@$35; powdered, $30@$60, f.o.b. New York.

Feldspar—Crude, $7.50@$8 per gross ton, f.o.b. Maryland and North Carolina

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

points; $7.50@$10 f.o.b. Maine; ground, $22@$25, car lots, f.o.b. Baltimore; ground, $16@$20, f.o.b. North Carolina points; $16 to $20 per ton, No. 1 ground, f.o.b. New York State.

Fluorspar—Standard grade, domestic washed gravel, f.o.b. Illinois and Kentucky mines, $25 per ton; lump, $17.50, f.o.b. Tonuco, N. M.

Fuller's Earth—Domestic, granular, $25; powdered, $18, f.o.b. mines, Florida; imported, powdered, $35@$40 per ton.

Graphite—Crucible flake, 85 per cent carbon content, 8c. per lb.; 88 per cent, 9½c.; 90 per cent, 10½c., all f.o.b. New York; 80 per cent, 5c.; 90 per cent, 10c.; 30 per cent (dust polish grade), 1c.; 50 per cent (dust facing grade) 2c.; f.o.b. Ashland, Ala. Mexican, amorphous, $45 @$55 per short ton; Korean, 3½c. per lb.; Madagascar, 8c.; Ceylon, 4¾@15½c.

Gypsum—Raw crushed rock, $3.50@ $4 per ton; raw ground fine, $4@$4.50; calcined stucco, $9, all f.o.b. works. Containers extra. Wholesale, plaster of paris, carload lots, $3.75 per 250-lb. bbl., alongside dock, New York.

Kaolin—See China Clay.

Limestone—For fluxing, $1.65@$1.75 per net ton, f.o.b. Howellville, Pa. Dolomite, 1@2 man size, $1.60@$1.65; 2@8 in., $1.55@$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.

Magnesite, Calcined — High-grade caustic calcined, lump form, $35@$40 per ton, carload lots, f.o.b. California points. Freshly ground calcined, suitable for flooring trade, $65@$75 per ton, f.o.b. Eastern points.

Dead-Burned — $32.50 per net ton, Chewelah, Wash.; $50@$60, Chester, Pa. Magnesite brick—See Refractories.

Mica—Imported block mica slightly stained, per lb.: No. 6, 50c.; No. 5, $1.20 @$1.40; No. 4, $2@$3; No. 3, $4.25@ $5; No. 2, $5.50@$7; No. 1, $8. Clear block: No. 6, 55c.; No. 5, $2; No. 4, $4; No. 3, $5.75; No. 2, $7; No. 1, $9; A1, $14; extra large, $25, all f.o.b. New York; ground, $85@$100 per ton, Philadelphia.

Monazite — Minimum of 6 per cent thorium oxide, $42 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports, 68 per cent tricalcium phosphate, $6.85; 70 per cent, $7.35; 74 to 75 per cent, $10; 75 per cent minimum, $10.50; 77 per cent minimum, $12.50.

Pumice Stone—Imported, lump, 4@ 50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish, fines, per unit 12c., c.i.f. Atlantic seaport; furnace size, 16½c.; run of mine, 12@14c.; domestic, fines, f.o.b. mines, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17, all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sulphur—$18 per ton for domestic; $20 for export, f.o.b. Texas and Louisiana mines; unchanged.

Talc—Paper making, $9.50@$14 per ton; roofing grades, $8@$9; rubber grades, $9@$15, all f.o.b. Vermont. California talc, $20@$35, talcum powder grade. Southern talc, powdered, carload lots, $12 per ton; less than carload, $15, f.o.b. cars. Freight to New York, $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $60 @$70.

Mineral Products

Arsenic—White arsenic, 14@15c. per lb.; sulphide, powdered, 20@21c. per lb., f.o.b. works.

Nitrate—Soda, $3.85 per cwt., ex vessel, Atlantic ports. Market quiet.

Potassium Sulphate—Domestic, $2.25 @$2.50 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrocarbontitanium—For 15-18 per cent material, $200@$250 per ton, f.o.b. Niagara Falls, N. Y.

[1]Ferrocerium—Per lb., $12@$15. Foreign conditions as affecting the price of American goods remain unchanged.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 19@20c. per lb. of chromium contained; 4 to 6 per cent carbon, 20@21c.

Ferromanganese—For 76@80 per cent, $250 spot; $225 prompt; $200 contract, freight allowed; Spiegeleisen, 18 to 22 per cent, $75, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50@$3 per lb. of contained metal.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $60@$65; 50 per cent, $80@$90; 75 per cent, $150 @$160.

Ferrotungsten—70 to 80 per cent W, 90c.@$1.10 per lb. of contained tungsten.

Ferro-uranium—35-50 per cent U, $7 per lb. of U contained.

Ferrovanadium—Basis 30-40 per cent, $6.50@$7.75 per lb. of V contained.

Metal Products

Copper Sheets—No change in Jan. 7 price of 29½c. per lb.; wire, quoted 22¼@22½c.

Lead Sheets—Full lead sheets, 12½c.; cut lead sheets, 12½c. in quantity, mill lots. Unchanged.

Nickel Silver—Unchanged at 39½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets, 26¾c.; sheathing, 25¾c.; rods, ⅜ to 3 in., 23¾c. Unchanged.

Zinc Sheets—$12.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 12c. per lb. Unchanged.

Refractories

Bauxite Brick—56 per cent alumina, $145 per 1,000, f.o.b. Pittsburgh.

[1]Furnished by Foote Mineral Co., Philadelphia, Pa.

Chrome Brick—$90@$100 per net ton, Chester, Pa., carload lots.

Chrome Cement—45 to 50 per cent Cr_2O_3, in sacks, $50 per net ton, Chester, Pa., carload lots.

Clay Brick — First-quality fire clay, 9-in. shapes, $45@$53 per thousand, f.o.b. Pennsylvania, Ohio, and Kentucky works; second quality, $40. First quality, St. Louis, $45; New Jersey, $75.

Magnesite Brick—$90@$100 per ton, f.o.b. Chester, Pa.; 9-in. straights, $90 per net ton, Baltimore; 9-in. sizes and shapes larger than 9 in., regular extras.

Silica Brick—Nine in. and 9-in. sizes, per 1,000, $51@$55, Birmingham, Ala.; $50@$55, Mount Union, Pa.; $55, Chicago district.

Iron Trade Review

Pittsburgh, July 6, 1920

The sheet and tin-plate tonnage wage scales, governing the sheet and tin mills that are operated as union, have been settled between the manufacturers involved and the Amalgamated Association, a few minor concessions being made to the men. As to the general organizing campaign for the iron and steel industry, the present prospect is that none will occur, at least in the near future.

Car supplies for shipping pig-iron and steel products have been poorer in the past fortnight than formerly, owing to the diversion of many open top cars to the coal movement. The industry is better supplied with coal, for fuel and byproduct coking, and hopes soon to have some of the cars back.

Pig Iron—Relatively small sales of bessemer and basic iron have been made, for early delivery, at $1 advance, or $45, Valley, and this seems to be the market. There is no interest in deliveries for late in the year, buyers apparently expecting a decline. We quote bessemer, basic and foundry all at $45, f.o.b. Valley furnaces, freight to Pittsburgh being $1.40. W. P. Snyder & Co. report average prices in June, computed from tonnage sales reported, at $43.494 for bessemer and $44.0075 for basic, Valley furnaces. Foundry was quoted at $45, Valley, throughout the month.

Steel—The market is quiet. Quotations, largely nominal, are: Billets, $60@$65; small billets, $65@$70; sheet bars, $75.

Charcoal and Coke

Charcoal—Willow, 7c. per lb. in bbls.; hardwood, 4½c. per lb., in 250-lb. bbls.

Connellsville — Furnace, $17.50@ $18.50; foundry, $18@$19.

New River — Furnace, $12.50@$15, and foundry, $12.50@$14 per ton.

Pocahontas—Furnace, $12.50@$13.50 per ton.

Wise County — Furnace, $12.50@$15 per ton; foundry, $12.50@$14 per ton.

The Relief of the South African Gold Mines

What the Rand Low-Grade Mines Commission Recommends To Ease the Critical Situation in The World's Leading Gold-Producing Center

IN VIEW of the strenuous attempt being made to help the gold miner out of his difficulties in the United States, an important contribution to the subject of relief for the industry elsewhere is contained in the report of the Rand Low-Grade Mines Commission presented to the Union Houses of Parliament, and issued the latter part of May. This is the commission that was appointed about one year ago by the South African government to study the critical situation in the low-grade gold mines of the Rand—the most important gold producing area in the world—due to the steady rise in working costs since the beginning of the war. Although preliminary statements were frequently made by the commission, the final report has just recently been issued.

Recommendations Summarized

The report contains no startling or unexpected recommendation or suggestion, the principal advocation being the importation of cheap colored labor from the tropics north of 22 deg. S. latitude to help reduce the high labor costs. The report deals at length with the disposal of gold, the procedure necessary to obviate the closing down of the mines, and the steps to be taken should abandonment of the work actually occur.

The effect of the vanishing gold premium was not as marked at the time the report was printed and issued (April of this year) as it is at the present time and the situation is continually becoming more acute.

Greatly Increased Costs

It is estimated that during the first half of 1915 working costs on the Witwatersrand mines averaged 17s. 5d. per ton; in the third quarter of 1919 they had advanced to 22s. 7d. and in the final quarter to 23s. 9d. An allowance of 1s. 8d. is made to bring the cost up to date, which indicates the steady upward trend.

The following comparative table reflects the increase in white and black labor costs, in general commodities, and the decrease in efficiency.

	First Half of 1914		First Quarter of 1919	
	Per Ton Milled			
White salaries and wages	5s.	1d.	7s.	1d.
Native wages	3	9	4	2
Stores and materials	5	5	7	10
Administration	0	5.7	0	6.3
Gold realization	0	3.1	0	6.3
Cost of development per foot	54	1	81	5
Tons handled per white employee	115.2	0	101.2	0
Tons handled per native employee	15.5	0	13.7	0

Elimination of Group Control

Opinion had been frequently expressed that costs could be materially lowered by elimination of group control—a feature of the South African gold mining industry—and that several shillings per ton could be economized in that manner. Evidence which the commission has gathered controverts this idea—the total administrative costs due to this arrangement being only about 6.3d. per ton milled. Economies to be effected in this direction "cannot possibly affect the position of the low-grade mines."

The charge that undue or hidden profits were being made by companies through the purchase of supplies for the mines and an overcharge for the service was unsubstantiated by the investigation.

Gold Marketing Costs

The commission deals at length with the gold premium the effect of which was first felt just after the commission had been appointed and a free gold market established. It recommends that the Union government approach the Imperial and Indian governments with a view to the free sale of South African gold in India—a great gold as well as silver consuming country. By this means it is hoped to compensate for the heavy discount—amounting to some 7 per cent—which under present arrangements is exacted by the banks in return for their service in marketing the gold. The seven per cent discount rate cuts heavily into the gold premium. The commission emphasizes the merely temporary nature of the premium and the transient respite given to the industry and is strongly in favor of the establishment of a mint in the union, rendering the producers less dependent upon outside assistance, and avoiding excessive refining charges in disposing of bullion through one channel.

The Abandonment of Operations

The effect of the closure of the mines and a curtailment of the industry is carefully considered, and that it would be a national calamity is well understood. The direct consequences would mean that some 250,000 white and a like number of blacks would be thrown out of employment and a means of livelihood. The loss in general revenue is estimated at £1,800,000 per month while that to the railways and harbors would at least be equally great.

On the other hand, it is assumed that a partial closing down of the mines will, to a certain extent, aid the operating ones by relieving the chronic shortage of native labor, enabling them to run at greater capacity. However, the exact extent to which such a step can be taken with beneficial results is a question, and can be easily overdone. It is a natural tendency for the low-grade mines in the most vulnerable condition to shut down first under the prevailing adverse conditions—just as in the United States those gold mines which were producing at or below cost were the first to close.

Government Subsidy

The matter of subsidizing the gold mines has been repeatedly advanced and as many times rejected. Save in exceptional circumstances the commission disfavors such subsidies. This recommendation is made on the grounds that support of a struggling gold mine would entitle the support of a struggling copper mine in a similar position, an argument that may be extended ad infinitum. It is held that economical principles regard unsound a policy which supports unpayable industries, diverting funds from profitable and permanent enterprises.

The Commission suggests exhaustive inquiry into general native labor policy and states that the well being of the native is not being sufficiently considered by the white population. The chief consideration is the profit and convenience of the European and the native is beginning to feel, and to say with considerable justice, that he is being exploited. The sooner such a feeling is eradicated the better for all concerned.

Notification of Closure

In the interests of maintaining mining operations wherever possible, it is suggested that at least three months' notice be given before shutting down a mine so that government inquiry may determine the merits of the individual case and assist operations as far as possible, and when mining operations are to be continued with a certain measure of government control, it is assumed that economy and efficiency of working require the utilization of the existing administration as far as possible.

On the whole the report has gone rather thoroughly into the handicaps which the South African gold mining industry is sustaining. All the measures of relief that are suggested remain to be tried out and what full measure of the burden will be removed by thorough action upon the recommendations is problematical. In the meantime the situation is continually becoming more critical.

COMPANY REPORTS

West End Consolidated Mining Company

Silver; Nevada

The thirteenth annual report of the West End Consolidated Mining Co. for 1919 summarizes operations at Tonopah as follows:

		Total	Per Ton
Dry tons ore to mill		33,140	
Containing: Fine ounces gold	6,114.61		
Fine ounces silver	580,445.10		
Total ounces	586,559.71		
Average value per ounce	$1.33		
Gross value West End ore milled		$780,786.49	$23.54
Mill costs, direct and indirect	130,106.53		3.93
Mill losses	64,483.44		1.93
Bullion marketing costs	11,452.83		.34
Mining cost, direct and indirect	167,971.41		5.07
Mine development costs	57,371.29		1.73
Ore transportation costs	8,285.00		.25
Written off for depreciation	11,868.38		.35
Total costs and losses		451,538.88	13.60
Profit from mining and milling ore from West End mine		$329,247.61	$9.94
Profit from West End operations in Jim Butler ground, under lease		5,217.39	
Profit from milling sand tails, custom ore and miscellaneous rents and earnings		17,534.73	
Interest		3,000,000	
Profit from West End operations in Jim Butler territory under "Fraction" vein agreement		33,000.00	
		$387,999.73	
Deduct: Strike expense	$20,072.38		
Loss on motor-truck operations	260.73		
Mine examinations outside Tonopah	457.56		
Deferred charges of years prior to 1919, writtenoff in 1919	4,031.98	24,822.65	
Net operating profit, 1919		363,177.08	

The balance of receipts over disbursements amounted to $17,838.67. Disbursements included dividends to stockholders amounting to $162,538.98 on the 1,788,486 shares of $5 par value outstanding. On Dec. 3, 1919, assets totaled $7,750,188.50 and liabilities $2,855,590.77 exclusive of depletion and adjustment accounts; surplus totaled $957,029.83.

On April 1, 1920, the West End Chemical Co., operating at Searles Lake, California, and the West End Opoteca Mines Co. operating in Honduras, C. A., were formed from the parent company by the distribution of one share of stock in each company as a dividend to stockholders in the property owning and parent company, the West End Consolidated Mining Co.

Poderosa Mining Co., Ltd.

Copper; Chile

The eleventh annual report of the Poderosa Mining Co., Ltd., a British corporation, shows a debit balance of £21,977 2s. 1d. for the year's operation. The net receipts from the sales of ore, interest, and transfer fees, amounted to £58,003 9s. 4d., and, after providing for mining, management, and general expense in Chile, London office expenses, depreciation of investments, and income tax amounting to £59,602 17s. 8d., there is a resulting debit balance of £1,599 8s. 4d., to which have to be added the following items: depreciation of building, machinery and plant, £3,208 10s. 4d.; mine development, £12,169 3s., 5d.; Bolivian property, £5,000, thus increasing the debit balance for the year to £21,977 2s. 1d. Deducting this amount from the balance of £29,266 11s. 3d. at credit of revenue account, there remains to that account a credit balance of £7,289 9s. 2d.

During the year 1,498 tons of copper ore of an average assay of 31 per cent copper and 12.97 oz. of silver per ton was shipped to the smelters, as compared to 3,309 tons, assaying 30.7 per cent copper and 12.45 oz. of silver per ton, in 1918.

Buena Tierra Mining Co., Ltd.

Silver-Lead; Mexico

The annual report of the Buena Tierra Mining Co., Ltd., a British corporation, for the year ending Dec. 31, 1919, shows a loss for the period of £11,507 9s. 6d. During the year 9,067 tons of ore was sent for treatment to the smelter, the average content of which was 11.73 oz. of silver and 12.92 per cent of lead, the net smelter return being $97,587, an average of $10.76 per ton. Working costs amounted to $143,611, or $15.40 per ton, which, however, includes $7.48 per ton for development. The profit and loss account for the year shows a net deficit of £4,727 4s. 3d. on Dec. 31, 1919.

Granite Gold Mining Co.

Gold; Colorado

The annual report of the Granite Gold Mining Co. shows a loss of $24,674.22 incurred by operation during 1919. Income from ore sales, royalties, leases, and interest amounted to $56,187.15. Mine expense was $28,123.22, leaving a profit on mine operations of $28,063.93. General expenses totaled $16,760.90 and depreciation charges were $35,977.25, giving a loss chargeable to surplus account of $24,674.22.

June, 1920, Mining Dividends

The following is a partial list of mining dividends paid during June, 1920:

U. S. Mining and Metallurgical Companies	Situation	Per Share	Total
Ahmeek Mining, c	Mich.	$0.50 q.	$100,000.00
Amer. Sm. & Ref., com	U. S.-Mex.	1.00 q.	609,980.00
Amer. Sm. & Ref., pfd	U. S.-Mex.	1.75 q.	875,000.00
Caledonia Mining, l. s	Idaho	.01 m.	26,050.00
Callahan Zinc & Lead	Idaho	.50 q.	161,651.50
Calumet & Arizona, c	Ariz.	1.00 q.	642,520.00
Calumet & Hecla, c	Mich.	5.00 q.	500,000.00
Chino Copper	N. M.	.37½ q.	326,242.50
Copper Range, c	Mich.	.50 q.	200,000.00
Cresson Consol. Gold	Col.	.10 q.	122,000.00
Federal M. & S., pfd	Idaho	1.75 q.	210,000.00
Grand Central, g. s	Utah	.01	15,000.00
Hecla Mining, l. s	Idaho	.20 q.-x.	200,000.00
Kennecott Copper	Alaska, etc.	.50 q.-c.	1,393,530.00
Nevada Consol. Copper	Nev.	.25 q.	499,864.25
Oroville Dredging, g	Cal.-S. A.	9 d.	£25,745.175
Osceola Consol., c	Mich.	.50 q.	48,075.00
Ray Consol., c	Ariz.	.25 q.	394,294.50
St. Joseph Lead	Mo.	.50 q.-x.	704,734.00
Tintic Standard, l. c	Utah	.10 q.	117,470.00
United Verde Copper	Ariz.	1.50 q.	450,000.00
Utah Copper	Utah	1.50 q.	2,436,735.00
Yellow Pine, s. l. s	Nev.	.03 q.	30,000.00
Canadian, Mexican and South American Companies	**Situation**	**Per Share**	**Total**
Cerro de Pasco Copper	Peru	$1.00 q.	$898,229.00
Hollinger Consol. Gold	Ont.	.05 bm.	246,000.00
Lake Shore, g	Ont.	.02	40,000.00
Mexico El Oro, g. s	Mex.	4 sh.	£36,000
Mining Corp. Canada, s	Ont.	.12½	$207,506.00
Holding Company			
St. Mary's Min. Land	Mich.	2.00	320,000.00

Rand Mines, Ltd., which is now listed on the New York Exchange, declared its thirty-fourth dividend of 60 per cent on its common 5s. shares. The Caledonia Mining and the Golden Cycle companies announced a change from monthly to quarterly dividends beginning this month, and Calumet & Hecla has this month resumed the quarterly payments, dropped in December, 1919. Federal Mining & Smelting resumes with this month's disbursement the old rate, dropped a year and a half ago, of $7 per annum. Isle Royale Copper Co. again passed its dividend. The last one was 50c., in September, 1919. New Jersey Zinc Co. stockholders authorized an increase in the capital stock to $50,000,000, and on June 10 received a stock dividend of 20 per cent on $35,000,000.

National Lead Co., of New Jersey, paid its regular quarterly dividends of $1.75 on the preferred and $1.50 on the common stock.

MINING STOCKS

Week Ended July 3, 1920

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Adventure	Boston	*75	*75	*75		
Ahmeek	Boston			61½	June '20, Q	.50
Alaska-B.C.	N. Y. Curb	1 1/16	1 1/16	1 1/16		
Allouez	Boston			28½	Mar. '19,	1.00
Anaconda	N. Y.	56¾	54¾	56¾	Feb. '20, Q	1.00
Ariz. Com'l	Boston	10	10	10	Oct. '18,	.50
Big Ledge	N. Y. Curb	⅜	1/16	1/16		
Bingham Mines	Boston	9	9	9	Sept. '19, Q	.25
Calumet & Ariz.	Boston	59	58¼	58½	June '20, Q	1.00
Calumet & Hecla	Boston	320	300	310	June '20, Q	5.00
Can. Copper	N. Y. Curb	1 1/16	1 1/16	1 1/16		
Centennial	Boston			12	Dec. '18, SA	1.00
Cerro de Pasco	N. Y.	42½	41½	42½	June '20, Q	1.00
Chief Consol.	Boston Curb	3½	3½	3½	Feb. '20, Q	.10
Chile Cop	N. Y.	15⅝	14⅝	15⅝		
Chino	N. Y.	30	27⅝	30	June '20, Q	.37½
Columbus Rexall	Salt Lake	*47	*44	*44		
Con. Ariz.	N. Y. Curb			1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb			3⅛		
Cop. Range	Boston	39	37½	39	June '20, Q	50
Crystal Cop. (new)	Boston Curb	*39	*26	*32		
Davis-Daly	Boston	9	8	9	Mar. '20, Q	.25
East Butte	Boston	13	12	12½	Dec. '19, A	.50
First Nat'l	Boston Curb	*95	*95	*95	Feb. '19, SA	.15
Franklin	Boston	2	1⅞	2		
Gadsden Copper	N. Y. Curb	*72	*70	*71		
Granby Consol.	N. Y.	35	35	35	May '19, Q	1.25
Greene-Can.	N. Y.	30½	30	30	Feb. '19, Q	1.50
Hancock	Boston	4½	4½	4½		
Houghton	Boston Curb	*60	*60	*60		
Howe Sound	N. Y. Curb			3⅞	Apr. '20, Q	.05
Inspiration Con.	N. Y.	50	47⅝	50	Apr. '20, Q	1.50
Iron Cap	Boston Curb	9	8½	8½	Feb. '19, M	.25
Isle Royale	Boston	30½	30	30½	Sept. '19, SA	.50
Kennecott	N. Y.	26⅜	24½	26⅜	June '20, Q	.50
Keweenaw	Boston			1 1/16		
Lake Copper	Boston			3¼		
La Salle	Boston	3½	2½	3		
Magma Chief	N. Y. Curb			*21		
Magma Copper	N. Y. Curb			29	Jan. '19, Q	.50
Majestic	Boston Curb	*18	*18	*18		
Mason Valley	N. Y. Curb			2⅛		
Mass. Con.	Boston			3½	Nov. '17, Q	1.00
Mayflower-O.C.	Boston	5⅜	5½	5⅜		
Miami	N. Y.	20¼	20	20¼	May '20, Q	.50
Michigan	Boston	4¼	4¼	4¼		
Mohawk	Boston	62	61	61¼	Feb. '20, Q	1.50
Mother Lode (new)	N. Y. Curb	6	5¼	5¼		
Nevada Con.	N. Y.	12¾	12½	12½	June '20, Q	.25
New Arcadian	Boston	3	2⅞	3		
New Baltic	Boston Curb			3		
New Cornelia	Boston	16⅛	16	16	May '20,	.25
Nixon Nev.	N. Y. Curb			*9		
North Butte	Boston	17½	16	17	Oct. '18, Q	.25
North Lake	Boston			*75		
Ohio Copper	N. Y. Curb			1/16		
Ojibway	Boston			1½		
Old Dominion	Boston	24½	24½	24½	Dec. '18, Q	1.00
Osceola	Boston	39	37¼	39	June '20, Q	.50
Phelps Dodge	Open Mar.	†195	†180		Apr. '20, Q	2.50
Quincy	Boston	50	49	50	Mar. '20, Q	1.00
Ray Con.	N. Y.	16½	16	16½	June '20, Q	.25
Ray Hercules	Boston Curb			*75		
St. Mary's M. L.	Boston	40	39	39	June '20, K	2.00
Seneca	Boston	13⅜	13⅜	13⅜		
Shannon	Boston	1⅛	1⅛	1⅛	Nov. '17, Q	.25
Shattuck Ariz.	N. Y.			8½	Jan. '20, Q	.25
South Lake	Boston			2⅛		
South Utah	Boston	*14	*14	*14		
Superior	Boston			5	Apr. '17,	1.00
Superior & Boston	Boston	3⅛	3⅛	3⅛		
Tenn. C. & C.	N. Y.	10	9⅞	10	May '18, I	1.00
Tuolumne	Boston	*75	*65	*65	May '13,	.10
United Verde Ex.	Boston Curb	32	31	31⅛	June '20, Q	1.50
Utah Con.	Boston	6½	6	6	Sept. '18,	.25
Utah Copper	N. Y.	67	64½	67	June '20, Q	1.50
Utah M. & T.	Boston	1½	1½	1½	Dec. '17,	.30
Victoria	Boston			2½		
Winona	Boston			*40		
Wolverine	Boston	16	15	15	Jan. '20, Q	.50
LEAD						
Hecla	N. Y. Curb	4⅛	4	4 1/16	June '20, QX	.20
St. Joseph Lead	N. Y.	15⅛	15⅛	15⅛	June '20, QX	.50
Stewart	Boston Curb	†*18		*16	Dec. '15,	.05
Utah Apex	Boston	1⅛	1 1/16	1 1/16	Nov. '18,	.25
ZINC						
Am. Z. L. & S.	N. Y.	14	13½	14	May '17,	1.00
Am. Z. L. & S. pf.	N. Y.	48	47	48	May '20, Q	1.50
Butte C. & Z.	N. Y.	7⅛	7⅛	7⅛	July, '18, I	.50
Butte & Superior	N. Y.	22⅛	21⅛	21⅛	Sept. '17,	1.25
Con. Interst. Cal.	N. Y.	13⅜	13⅜	13⅜	June '20, Q	.50
New Jersey Z.	N. Y. Curb	200¼	196	197	May '20, SA	4.00
Success	N. Y. Curb	*6	*4½	*5½	July '16,	.03
Yellow Pine	Los Angeles	‡		1.02	June '20, Q	.03

*Cents per share. †Bid or asked. ‡Quotations missing. Q, Quarterly. SA, Semi-annually. BM, bimonthly. K, Irregular. I, Initial. X, includes extra

Stock	Exch.	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	N. Y.	1⅛	1⅛	1⅛		
Alaska Juneau	N. Y.	2¼	2¼	2¼		
Carson Hill	N. Y. Curb	28	27½	27½		
Cresson Consol. G.	N. Y. Curb			1⅞	June '20, Q	.10
Dome Ex.	Toronto	*24	*23½	*23½		
Dome Mines	N. Y.	9⅞	9⅝	9⅝	Apr. '20, Q	.25
Golden Cycle	Colo. Sprgs.			*73	May '20, Q	.02
Goldfield Con.	N. Y. Curb	*10	*9	*9½	Dec. '19,	.05
Hedley	Boston			4¼	June '19,	.10
Hollinger Con.	Toronto	5.70	5.61	5.61	June '20, BM	.05
Homestake	N. Y.			55	Sept. '19,	.50
Kirkland Lake	Toronto	*46	*45	*45		
Lake Shore	Toronto	1.18	1.17	1.18	Oct. '19,	.02½
McIntyre-Porcupine	Toronto	1.81	1.80	1.81	May '20, K	.05
Porcupine Crown	Toronto	*27	*26½	*27	July '17,	.03
Portland	Colo. Sprgs.	‡		*60	Apr '20, Q	.01½
Reorgan. Booth	N. Y. Curb	*6	*4½	*4½	May '19,	.05
Silver Pick	N. Y. Curb	*7	*5	*5½		
Teck Hughes	Toronto	*8½	*8½	*8½		
Tom Reed	Los Angeles	‡		1.32	Dec. '19,	.02
United Eastern	N. Y. Curb	3	2 1/16	2⅛	Apr. '20, Q	.21
Vindicator Consol.	Colo. Sprgs.	‡		*18	Jan. '20, Q	.01
West Dome	Toronto			*6½		
White Caps Min.	N. Y. Curb	*10	*9	*10		
Yukon Gold	Boston Curb			1	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*37	*13	*15	Apr. '20, M	.03
Beaver Con.	Toronto	*41	*40½	*40½	May '20, K	.03
Coniagas	Toronto	†2.55	†2.90		May '20, Q	.25
Crown Reserve	Toronto	*19	*19	*19	Jan. '17,	.05
Kerr Lake	Boston	3⅛	3⅛	3⅛	Sept. '19,	1.00
La Rose	Toronto	†*37	†*33	*33	Apr. '18,	.02
McKinley-Dar.	N. Y. Curb			*48	Apr. '20, Q	.03
Mining Corp.	Toronto			1.90	June '20, Q	.12½
Nipissing	N. Y. Curb	9	8⅛	8⅛	Apr. '20, Q	.25
Ontario Silver	N. Y.	6⅛	6	6⅛	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	1/16	1/16	1/16	Jan. '12,	.10
Peterson Lake	Toronto	*12½	*12¼	*12¼	Jan. '17,	.01½
Sil. King Ariz.	N. Y. Curb	*48	*38	*48		
Temiskaming	Toronto	*34	*33	*34	Jan. '20, K	.04
Trethewey	Toronto	*29¾	*29¼	*29½	Jan. '19,	.05
GOLD AND SILVER						
Atlanta	N. Y. Curb	*2	*1	*2		
Barnes-King	Butte	‡		1.28	Nov. '19, Q	.05
Bost. & Mont.	N. Y. Curb	*63	*60	*62		
Cashboy	N. Y. Curb	*7	*6	*6½		
El Salvador	N. Y. Curb	2½	2	2½		
Jim Butler	N. Y. Curb	*13	*12	*13	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*6	*4½	*5½	June '16,	.05
Louisiana Con.	N. Y. Curb	1/16	1/16	1/16		
MacNamara M.	N. Y. Curb	1/16	1/16	1/16	May '10,	.02½
N.Y. Hond. Rosar	Open Mar.	†13½	†12¼		Apr. '20, Q	.50
Tonopah-Belmont	N. Y. Curb	1⅛	1⅛	1⅛	Jan. '20, Q	.05
Tonopah-Divide	N. Y. Curb	1⅛	1 1/16	1 1/16		
Tonopah Ex.	N. Y. Curb	1⅛	1 1/16	1⅛	Apr. '20, Q	.05
Tonopah Mining	N. Y. Curb	1⅛	1⅛	1⅛	Oct. '19, SA	.15
West End Con.	N. Y. Curb	1 1/16	1⅛	1 1/16	Dec. '19 SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*24	*22	*23	June, '20, M	.01
Consol. M. & S.	Montreal	26	25	25⅜	Apr. '20, Q	.62½
Daly-West	Boston			4⅜	Apr. '20, Q	.15
Eagle & Blue Bell	Boston Curb	2 1/16	2 1/16	2 1/16	Apr. '20, Q	.10
Electric Point	Spokane	36	35	35	May '20, SA	.03
Fed. M. & S.	N. Y.			13½	Jan. '09,	1.50
Fed. M. & S. pf.	N. Y.	36½	36	36	June, '20, Q	1.75
Florence Silver	Spokane			*45	Apr. '19,	.01½
Iron Blossom	N. Y. Curb	⅜	1/16	¼	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake			4.00	Apr. '20, A	.12½
Marsh Mines	N. Y. Curb	*13	*10	*11		
Prince Consol.	N. Y. Curb	⅜	1/16	⅜	Nov. '17,	.02½
Rambler-Cariboo	Spokane			*12½	Feb. '19,	.01
Rex Con.	N. Y. Curb	*7	*6	*7		
South Heela	Salt Lake			*94	Sept. '19, K	0.15
Stand. S. L.	N. Y. Curb	¼	1/16	½	Oct. '17,	.05
Tamarack-Custer	Spokane	2.55	2.50	2.55	Dec. '19, K	.03
Tintic Standard	Salt Lake	3.10	2.90	3.10	June '20, Q	0.10
Wilbert	N. Y. Curb	*5	*4	*4	Nov. '17,	.01
NICKEL-COPPER						
Internat'l Nickel	N. Y.	17⅛	17	17⅛	Mar. '19,	.50
Internat'l Nick.pf.	N. Y.			82	May '20, Q	1.50
QUICKSILVER						
New Idria	Boston			6	Jan. '19,	.25
TUNGSTEN						
Mojave Tungsten	Boston Curb			*10		
VANADIUM						
Vanadium Corp.	N. Y.	92	82¼	92	Apr. '20, I	1.50
ASBESTOS						
Asbestos Corp.	Montreal	85	81	83	Apr. '20, Q	1.25
Asbestos Corp. pf.	Montreal	93½	92½	92½	Apr. '20, Q	1.50
MINING, SMELTING AND REFINING						
Am. S. & R.	N. Y.	60	57	60	June '20, Q	1.00
Am. S. & R.pf.	N. Y.	90	90	90	June '20, Q	1.75
Am. Sm. pf.A	N. Y.	73½	73½	73½	Apr. '20, Q	1.50
U. S. Sm. R. & M.	N. Y.	59¼	57	59¼	Apr. '20, Q	1.50
U.S.S.R.& M. pf.	Boston	45	43⅜	45	Apr. '20, Q	.87½

CURRENT PRICES OF MATERIALS AND SUPPLIES

IRON AND STEEL

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	St. Louis	Chicago	San Francisco	New York Current	New York One Yr. Ago
No. 10	$3.55–7.00	7.09	7.02	8.25	$6.62–8.00	4.57
No. 12	3.60–7.05	7.09	7.07	8.30	6.67–8.05	4.62
No. 14	3.65–7.10	7.09	7.12	8.35	6.72–8.10	4.67
Black:						
Nos. 18 and 20	4.15–7.30	8.10	7.80	9.35	7.80–8.80	5.17
Nos. 22 and 24	4.20–7.35	8.10	7.85	9.46	7.85–8.85	5.22
No. 26	4.25–7.40	8.10	7.90	9.45	7.90–8.90	5.27
No. 28	4.35–7.50	8.10	8.00	9.55	8.00–9.00	5.37
Galvanized:						
No. 10	5.80–7.50	9.60	8.50	....	8.25–10.00	5.50
No. 12	4.80–7.60	9.60	8.60	10.10	8.35–10.10	5.55
No. 14	4.80–7.60	9.60	8.60	10.10	8.35–10.10	5.60
Nos. 18 and 20	5.10–7.90	9.60	8.90	10.40	8.65–10.40	5.90
Nos. 22 and 24	5.25–8.05	9.60	9.05	10.55	8.80–10.55	6.05
No. 26	5.40–8.20	9.60	9.20	10.70	8.95–10.70	6.20
No. 28	5.70–8.50	9.60	9.50	11.00	9.25–11.00	6.50

Acute scarcity in sheets, particularly black, galvanized and No. 16 blue enameled. Automobile sheets are unavailable, except in fugitive instances, when prices range to 15c. per lb.

STEEL RAILS—The following quotations are per ton f. o. b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago Current	Chicago One Year Ago
Standard bessemer rails	$45.00@$60.00	$45.00	$45.00@$60.00	$45.00
Standard openhearth rails	47.00@ 60.00	47.00	47.00@ 60.00	47.00
Light rails, 8 to 10 lb	50@55	2.585*	2.585*@3.75	2.835*
Light rails, 12 to 14 lb	49@75	2.54*	2.54* @3.75	2.79*
Light rails, 25 to 45 lb	49@75	2.45*	2.45* @3.75	2.70*

* Per 100 lb.
NOTE—The lower price is that of the U. S. Steel Corp.

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco
Standard railroad spikes, ⅝ in. and larger	$4.00	$3.25	$3.62	$5.34	$5.65
Track bolts	6.00–6.50	4.90	4.62	6.50	6.65
Standard section angle bars	3.00–4.00	3.00	3.02	3.00	4.90

STRUCTURAL MATERIAL—The following are the base prices f.o.b. mill, Pittsburgh, together with the quotations per 100 lb. from warehouses at the $2.55 places named:

	Mill Pittsburgh	New York Current	New York 1 Year Ago	St. Louis	Chicago
Beams, 3 to 15 in	$2.45@$3.75	$4 47	$3.47	$4.04	$3.97
Channels, 3 to 15 in	2.45@ 3.75	4 47	3.47	4.04	3.97
Angles, 3 to 6 in., ¼ in. thick	2.45@ 3.75	4 47	3.47	4.04	3.97
Tees, 3 in. and larger	2.45@ 3.75	4.52	3.52	4.09	4.02
Plates	2.65@ 3.75	4.67	3.67	4.24	4.17

STEEL SHEET PILING—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago:

Current	One Month Ago	One Year Ago
$2.55@$3.65	$2.55@$3.65	$2.55

RIVETS—The following quotations are per 100 lb.:

	STRUCTURAL Warehouse					
	Mill Pittsburgh	New York Current	New York One Year Ago	Chicago	St. Louis	San Francisco	Dallas
½ in. and larger	$4.50	$6.00	$5.05	$5.37	$5.44	$6.65	$7.50
CONE HEAD BOILER							
½ in. and larger	4.60	7.10	5.15	5.47	5.54	6.75	7.50
⅝ and ¾	4.75	7.25	5.30	6.62	5.54	7.00	7.50
⅞ and 1	5.00	7.00	5.55	5.97	5.54	7.25	7.75

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	New York and St. Louis
Hercules red strand, all constructions	20%
Patent flattened strand special and cast steel	20%
Patent flattened strand iron rope	5%
Plow steel round strand rope	30%
Special steel round strand rope	30%
Cast steel round strand rope	22½%
Iron strand and iron tiller	5%
Galvanized iron rigging and guy rope	+12%

San Francisco: Galvanized, iron rigging and guy ropes, +17½%; bright plow, 25% off.
Chicago, + 12½ on galvanized, 30 off on bright.

HORSE AND MULE SHOES—Warehouse prices per 100 lb. in cities named:

	Mill Pittsburgh	Cincinnati	Chicago	St. Louis	Birmingham
Straight	$5.75	$7.50	$7.00	$7.00	$7.00
Assorted	5.85	7.50	7.15	7.15	7.25

BAR IRON AND STEEL—Per 100 lb. to large buyers at mill, Pittsburgh:
Iron bars.....$2.35@$4.00 Steel bars.....$4.27@$4.50

COAL BIT STEEL—Warehouse price per pound is as follows:

New York	Cincinnati	Birmingham	St. Louis	Chicago
$0.10	$0.16½	$0.18	$0.11	$0.15

DRILL STEEL—Warehouse price per pound:

	New York	St. Louis	Birmingham
Solid	12@14c.	13c.	15c.
Hollow	16c.	.....	.....

STEEL AND IRON—The following discounts are to jobbers for carload lots on the Pittsburgh basing card, discounts on steel pipe, applying as from January 14, 1920, and on iron pipe from January 7, 1920:

Inches	Black	Galv.	Inches	Black	Galv.
	BUTT WELD				
¼ to 3	57 @ 54	44@ 41½	¼ to 1¼	34½ @ 24½	18½ @ 8
			2 and 2½	33½	17½
	LAP WELD				
2	50½ @ 47	38 @ 34½	2	28½ @ 20½	14½ @ 6½
2½ to 6	53½ @ 50	41 @ 37½	2½ to 6	30½ @ 22½	17½ @ 9½
7 to 12	50½ @ 47	37 @ 33½	7 to 12	27½ @ 19½	14½ @ 6½
13 and 14	41 @ 37½	.....			
15	38 @ 35	.....			
	BUTT-WELD, EXTRA STRONG, PLAIN ENDS				
¼ to 1¼	55½ @ 52	39½	¼ to 1¼	34½ @ 24½	19½ @ 9½
2 to 3	56½ @ 53	44 @ 40½	2 and 2½	34½ @ 24½	19½ @ 9½
	LAP WELD, EXTRA STRONG, PLAIN ENDS				
2	48½ @ 45	37 @ 33½	2	29½ @ 21½	16½ @ 8½
2½ to 4	51½ @ 48	40 @ 36½	2½ to 4	31½ @ 23½	19½ @ 11½
4½ to 6	50½ @ 47	39 @ 35½	4½ to 6	30½ @ 22½	18½ @ 10½
7 to 8	46½ @ 43	33 @ 29½	7 to 8	22½ @ 14½	10½ @ 2½
9 to 12	41½ @ 38	28 @ 24½	9 to 12	17½ @ 9½	5½ @ 5½

From warehouses at the places named the following discounts hold for steel pipe:

	New York	Black Cleveland	Black Chicago
¼ to 3 in. butt welded	40%	40%	40@54%
3½ to 6 in. lap welded	35%	42%	40@50%
	New York	Galvanized Cleveland	Galvanized Chicago
¼ to 3 in. butt welded	24%	31%	30 @40½%
3½ to 6 in. lap welded	20%	27%	27½@37½%

Malleable fittings, Class B and C, from New York stock sell at list plus 22½%. Cast iron, standard sizes, net.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York Current	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Hot pressed square	+$4.00	$1.28	$0.75	$1.90	$0.50	$2.00
Hot pressed hexagon	+ 4.00	.85	.75	1.90	.50	2.00
Cold punched square	+ 4.00	1.00	.75	1.90	.50	1.30
Cold punched hexagon	+ 4.00	1.00	.75	1.90	.50	1.30

Semi-finished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	30%	50–10%
Chicago	50%	50%
Cleveland	50%	60–10–10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
¾ by 4 in. and smaller	list	20%	20%
Larger and longer up to 1 in. by 30 in	+20%	20–10%	10%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... List Cleveland..... $3.00 Chicago..... $3.00
For cast-iron washers the base price per 100 lb. is as follows:
New York..... $7.00 Cleveland..... $4.50 Chicago..... $4.75

CONSTRUCTION MATERIALS

PREPARED ROOFINGS—Standard grade rubbered surface, complete with nails and cement, costs per square as follows at manufacturing points:

	1-Ply c.l.	2-Ply l.c.l.	3-Ply c.l.
No. 1 grade	$2.40	$2.90	$3.45
No. 2 grade	2.15	2.00	3.10

Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $3.50 per roll in carload lots and $3.75 for smaller quantities.

Shingles, red and green slate finish, cost $7.75 per square in carloads; $8.00 in smaller quantities, in Philadelphia.

ROOFING MATERIALS—Prices per ton f.o.b. New York and Chicago:

Tar felt (14 lb. per square of 100 sq.ft.) per roll	$3.50
Tar pitch (in 400-lb. bbl.) per 100 lb.	1.85
Asphalt pitch (in barrels) per ton	46.50
Asphalt felt (light) per ton	118.00
Asphalt felt (heavy) per ton	119 50

HOLLOW TILE—

	4 x 12 x 12	8 x 12 x 12	12 x 12 x 12
Minneapolis	$0.087	$0.158	$0.248
Seattle	.09	.175	.30
Los Angeles	.10	.175	.....
New Orleans	.238	.304	.43
Cincinnati	.125	.2186	.3286

LUMBER—Price per M in carload lots:

	8 x 8-In. x 20-Ft. and Under			12 x 12-in. 20 Ft. and Under	
	P.	Fir	Hemlock	Spruce	P.	Fir
Boston	$100.00	$85.00	.....	$80.00	$110.00	$105.00
Kansas City	51.00	51.25	$51.25	51.25	60.00	51.25
Seattle	.....	34.00	.....	.....	.....	35.00
New Orleans	53.00	.....	.....	.....	59.00	.....
St. Paul	62.00	61.00	61.00	47.50	43.00	58.00
Atlanta	62.50	64.50	66.00	76.00	79.50	82.00
Baltimore	75.00	.....	.....	.....	87.50	.....
Cincinnati	45.00	50.00	50.00	.....	55.00	55.00
Montreal	80.00	80.00	65.00	75.00	73.00*	100.00
Los Angeles†	.....	57.00	.....	.....	.....	59.00
Denver	.....	65.00	65.00	65.00	.....	66.00

	1-In. Rough, 10-In. x 16-Ft. and under			2-In. T. and Gr. 10 In. x 16 Ft.	
	P.	Fir	Hemlock	P.	Fir
Boston	$115.00	$85.00	$65.00	$100.00	$85.00
Kansas City	102.00	106.50	106.50	113.00	112.75
Seattle	.....	37.50	.....	.....	38.50
New Orleans	61.00	.....	.....	67.50	.....
St. Paul	54.00	54.00	53.00	64.50	58.50
Atlanta	85.00	90.00	.....	77.50	87.50
Baltimore (box)	65@67.50	.....	.....	60–65.00	.....
Cincinnati	50.00	55.00	50.00	45.00	50.00
Montreal	75.00	75.00	66.00	.....	.....
Los Angeles	.....	58.00	.....	.....	.....
Denver	.....	62.00	62.00	140.00	127.50

*Montreal—Up to 32 ft.; over which, $3.00 per M. increase up to 30 ft.
† Base price, 2 x 3's and 2 x 4's, 8 to 14 ft., is $54.00
Detroit—Dimension stuff ranges from $60 to $68.

NAILS—The following quotations are per keg from warehouse:

	Mill Pittsburgh	St. Louis	Dallas	Chicago	San Francisco
Wire	$3.25@4	$4.50	$6.90	$4.15	$5.50
Cut	.....	5.40	7.40	6.45	6.90

PORTLAND CEMENT—These prices are for barrels in carload lots, without bags.

	Current	One Month Ago	One Year Ago Without Bags
New York (delivered)	$3.80	$3.30	$2.30
Jersey City (delivered)	2.97	2.47	2.27
Boston	2.60	2.60	2.42
Chicago	2.15	2.15	2.00
Pittsburgh	2.20	2.20	2.05
Cleveland	2.42	2.42	2.32

NOTE—Charge for bags is generally 25c. each, $1 per bbl.

LIME—Warehouse prices:

	Hydrated per Ton		Lump per 200-lb. Barrel	
	Finished	Common	Finished	Common
New York	$19.50	$18.50	$3.50*at plant	$3.30*
Kansas City	27.20	26.20	2.50	2.40
Chicago	.....	.....	2.40	1.75
St. Louis	25.00	21.00	.....	2.25
Boston	26.25	24.25	3.40†	3.25†
San Francisco	23.50	19.50	.....	2.25
Minneapolis	24.00	19.00	1.80†	1.60
New Orleans	.....	2.25†	.....	2.45

NOTE—Refund of $0.10 per barrel.
* 300-lb. barrels. † 180-lb. barrels.

LINSEED OIL—These prices are per gallon:

	New York		Chicago	
	Current	Year Ago	Current	Year Ago
Raw per barrel (5 bbl. lots)	$1.58	$1.90	$2.02	$2.10
5-gal. cans	1.60*	2.03	2.27	2.30

* To this *oil* price must be added the cost of the cans (returnable), which is $2.25 for a case of six.

WHITE AND RED LEADS—500-lb. lots sell as follows in cents per pound:

	Red				White	
	Current		One Year Ago		Current Dry and In Oil	1 Yr. Ago Dry and In Oil
	Dry	In Oil	Dry	In Oil		
100-lb. keg	15.50	17.00	13.00	14.50	15.50	13.00
25- and 50-lb. kegs	15.75	17.25	13.25	14.75	15.75	13.25
12½-lb. keg	16.00	17.50	13.50	15.00	16.00	13.50
5-lb. cans	18.50	20.00	15.00	16.50	18.50	15.00
1-lb. cans	20.50	22.00	16.00	17.50	20.50	16.00

MINING AND MILLING SUPPLIES

HOSE—

FIRE

	50-Ft. Lengths
Underwriters' 2½ in	$0.85 per ft.
Common, 2½-in	30%

AIR

	First Grade	Second Grade	Third Grade
¾-in. per ft	$0.60	$0.40	$0.30

STEAM—DISCOUNTS FROM LIST

First grade..... 20% Second grade.... 30% Third grade..... 35%

LEATHER BELTING—Present discounts from fair quantities (½ doz. rolls):

Light Grade	Medium Grade	Heavy Grade
30%	30%	20%

RAWHIDE LACING—For cut, best grade, 25%, 2nd grade, 30%. For laces in sides, 79c. per sq. ft.; 2nd, 75c. For semi-tanned: out, 20%; sides, 83c. per sq. ft.

MANILA ROPE—For rope smaller than ½-in. the price is ½ to $0.02 extra while for quantities amounting to less than 600 ft. there is an extra charge of $0.01. The number of feet per pound for the various sizes is as follows: ⅜-in., 8 ft., ½-in., 6; ⅝-in., 4½; ¾-in., 1½-in., 2 ft. 10 in.; 1¼-in., 2 ft. 4 in. Following is price per pound for ⅜ in. and larger, in 1200-ft. coils:

Boston	$0.30½	Kansas City	0.305
New York	.29	New Orleans	.29
Cincinnati	.27	Seattle	.28
Chicago	.275	St. Louis	.265
St. Paul	.275	Atlanta	.295
San Francisco	.27		

PACKING—Prices per pound:

Rubber and duck for low-pressure steam	$1.00
Asbestos for high-pressure steam	1.70
Duck and rubber for piston packing	1.00
Flax, regular	1.20
Flax, waterproofed	1.70
Compressed asbestos sheet	.90
Wire insertion asbestos sheet	1.50
Rubber sheet	.50
Rubber sheet, wire insertion	.70
Rubber sheet, duck insertion	.50
Rubber sheet, cloth insertion	.30
Asbestos packing, twisted or braided and graphited, for valve stems and stuffing boxes	1.30
Asbestos wick, ½- and 1-lb. balls	.85

RAILWAY TIES—For fair size orders, the following prices per tie hold:

Material	7 In. x 9 In. by 8 Ft. 6 In.	6 In. x 8 In. by 8 Ft.
Chicago—Plain	$1.75	$1.60
Chicago—Creosoted	1.95	1.80
San Francisco—Douglas fir, green	1.74	1.24
San Francisco—Douglas fir, creosoted	3.36	2.38

Prices per tie at Missouri mills; St. Louis prices about 25c. higher:

Untreated A Grade White Oak 6x8x8		Untreated A Grade Red Oak 6x8x8	
No. 1	$0.70	No. 1	$0.55
No. 2	.80	No. 2	.65
No. 3	.90	No. 3	.75
No. 4	.98	No. 5	.87
7x9x8 white oak	1.05		
7x9x8 red oak, No. 4	.80		

FLOTATION OILS—Prices of oils for flotation, in cents per gal. in bbls.:

	New York	Chicago In Bbl.	Chicago Carloads
Pure steam-distilled pine oil, sp.gr. 0.93–0.94	$1.80	$2.00	$1.95
Pure destructively distilled pine oil	1.60	1.90	1.85
Pine tar oil, sp.gr. 1.025-1.035	.48	.45	.43
Crude turpentine, sp.gr. 0.900–0.970	1.75	2.25	2.18
Hardwood creosote, sp.gr. 0.96–0.99*	.35	.....	.....

*F. o. b. Cadillac, Mich.

COTTON WASTE—The following prices are in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
White	11.00–15.50	13.00	16.00	11.00–14.00
Colored mixed	7.00–10.50	9.00–12.00	12.00	9.50–12.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x13½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

EXPLOSIVES—Price per pound of dynamite in small lots and price per 25 lb. keg for black powder:

	Low Freezing	Gelatin			Blacl.
	20%	40%	60%	80%	Powde
New York	.....	$0.3425	$0.3425	.....	$2.30
Boston	$0.225–24	.245–28	.25–31	.3525	2.40
Kansas City	.2475	.27	.30	.3425	2.45
New Orleans	.2425*	.2825	.2825	.38	2.45
Seattle	.18	.2175	.2475	.29	2.60
Chicago	.2175	.2525	.2975	.34	2.45
St. Paul	.185	.2275	.2525	.2950	2.25
St. Louis	.2175	.26	.285	.295	1.90
Denver	.205	.2475	.2725	.315	2.50
Dallas	.265	.275	.3025	.....	2.60
Los Angeles	.22	.27	.31	.....	2.95
Atlanta	.22	.245	.265	.....	2.55
Baltimore	.225	.2675	.3075	.325	2.40
Cincinnati	.2275	.2525	.2725	.....	2.30
Montreal	.28	.31	.34	.38	3.90

* For 50%.

CHEMICALS

SODIUM CYANIDE—New York price is 24@25c. per lb.; Chicago, 30c.; St. Louis, 31c.; Birmingham, 45c.

SODIUM SULPHIDE—New York price per pound is 9c.@10c. for concentrated, Chicago, 5c. for concentrated, 3½c. for crystals. Concentrated comes in 500-lb. drums; crystals in 440-lb. bbls.

ZINC DUST—For 350 mesh the New York price is 12½c. per lb.; Chicago, 12½c.; St. Louis, 12c.

ALUMINUM DUST—Chicago price is $1.10 per lb.; Birmingham, $1.52.

MINERS' LAMP CARBIDE—Prices net f.o.b. cars at warehouse points:

	Union 100-Lb. Drums Per Ton	Cameo 100-Lb. Drums Per Ton	Union Single 25-Lb. Drums	Union 25-Lb. Ton Lots
East of the Mississippi, North of Chattanooga	$106.00	$101.00	$1.52	$1.49
Southeastern portion U. S. A.	115.50	110.50	1.63	1.60
Texas (except E. Paso)	124.00	119.00	1.74	1.71
El Paso, Texas	126.00	121.00	1.77	1.73
Denver, Colo	124.00	119.00	1.74	1.71
West Coast	129.00	124.00	1.81	1.77

INDUSTRIAL NEWS

Oliver Continuous Filter Co., Hooker-Lent Building, San Francisco, Cal., is opening a London office to be in charge of J. F. Mitchell-Roberts.

Albert E. Jenkins, connected for many years with the technical staff of the Grasselli Chemical Co., Cleveland, Ohio, died of heart disease Tuesday, June 22.

Western Electric Co., Inc., has opened a supply sub-warehouse at 930 West Rayan Ave., Youngstown, Ohio. C. A. Strauss is in charge of sales, and H. B. Bergman in charge of stores.

Refinite Company, Omaha, Neb., has purchased ownership and control of **L. M. Booth Co.**, New York, N. Y., makers of Booth Lime-Soda water softener for large steam power and central heating plants.

General Briquetting Co., 25 Broad St., New York, N. Y., announces that Henry Schoch, of that company, has been elected vice-president of **Nukol Fuel Co.**, Toronto, Ont., and now has headquarters in Toronto.

National Industrial Traffic League, Chicago, Ill., announces that on June 1, Joseph H. Beck, of St. Paul, Minn., assumed the duties of executive secretary, vice Guy M. Freer, deceased. His address is 411 Tacoma Bldg., 5 North LaSalle St., Chicago.

Nordberg Manufacturing Company, Milwaukee, Wis., announces that B. V. E. Nordberg has been appointed sales manager. H. W. Dow, former sales manager, recently resigned to become vice-president and engineer of the Forest Products Chemical Co., Memphis, Tenn.

Worthington Pump & Machinery Corporation, 115 Broadway, New York, N. Y., has purchased from the Platt Iron Works, Dayton, Ohio, drawings, patterns, good will and name on the latter's lines of oil mill machinery, hydraulic turbine line, feed water heaters, and high pressure air compressors.

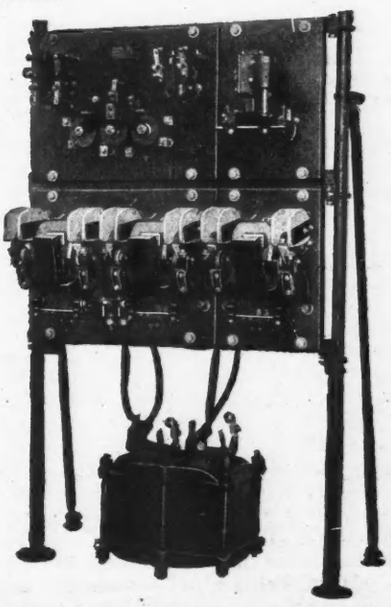
Metal & Thermit Corporation, New York, N. Y., announces the appointment of Charles F. Lederer to its rail-welding department. Mr. Lederer was recently superintendent of the way of the Milwaukee Electric Railway & Light Co., a company he had been with since 1908, and has had extensive experience in the application of Thermit in solving way department problems.

Dwight P. Robinson & Co., Inc., 125 East 46th St., New York, announce consolidation with Westinghouse, Church, Kerr & Co., Inc., under the former's name. Dwight P. Robinson is president and A. K. Wood, a vice-president and treasurer of the consolidation. H. H. Kerr is a vice-president in charge of the Chicago office, and W. L. Murray is secretary. Among the members of the directorate are Paul D. Cravath, John R. McGinley, and Harry T. Peters.

Edward Dauble, president of Union Tool Co., Torrance, Cal., died suddenly May 27 following an operation. Mr. Dauble was a native of Titusville, Pa., in his forty-sixth year. He early began to develop oil well drilling tools and machinery. In 1898 he went to Santa Paula, Cal., but soon moved his well-tools plant to Los Angeles, and in 1908 he consolidated his own great factory with the American Engineering & Foundry Co., forming the present Union Tool Co. This is one of the great plants of the southwest and now has works at West Chicago, Ill., Carnegie, Pa., and Torrance, Cal.

Starter for Mine-Fan Motors

The Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has developed a control panel for the automatic starting of polyphase squirrel-cage induction motors driving loads of great inertia, such as mine fans, which require several minutes to come up to speed. This controller is essentially an automatic starter of the auto-transformer type, and consists of three double-pole magnetic contactors, two auto-transformers, a current-limit relay, and a time-limit relay, with the necessary auxiliary magnetic switches. The switch equipment is mounted on slate panels carried on a floor frame, with the transformers mounted separately. One contactor acts as a main-line switch, and the two other contactors connect the motor to the starting taps of the transformers and to the line respectively. The interval between the closing of the second and third contactors, which is the time given the motor to come up to speed, is governed by the series-current relay and the dash-pot relay, either of which is externally adjustable for current of time values. The starter may be controlled from remote points; and, the adjustable feature of its two relays adapt it to almost all operating conditions.



AUTOMATIC STARTER FOR MINE FAN MOTORS

The Balanced Skip-Hoist Transporter

An Improved Coal-Handling Equipment Hoists and Distributes Materials at Half Previous Cost

BY WARREN TRAVELL

So much attention has been given during the last few years to the design and construction of material-handling apparatus, that a radical improvement in this line is hardly to be expected, and, when made, is a matter of interest to many. Such an improvement has recently been patented by the writer and is now being manufactured by the Exeter Machine Works, Inc., 30 Church St., New York.

Of all the many forms of hoisting equipment which have been developed and used for the saving of labor, the skip-hoist probably holds the first position as regards priority. The earliest type consisted simply of a windlass with a tub or bucket; later, guide rails were added, and a cage structure was adopted, resulting finally in the modern passenger elevator and the deep mine hoist of great speed and capacity.

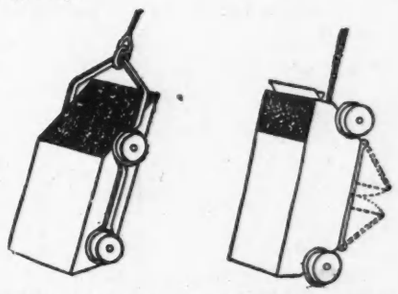


FIG. 1. EXETER MACHINE WORKS IMPROVED SKIP

One branch of this development dating back more than a hundred years produced the inclined skip-hoist having a skip with four wheels running on a pair of inclined rails. To automatically dump the skip, the tread of the upper pair of wheels was made narrower than that of the lower pair, and the track for these wheels was curved at the upper limit of hoist, and a wider gage track carrying the lower wheels was continued straight on for a short distance. This gave a simple and efficient hoisting machine and one which in thousands of installations has proved entirely satisfactory.

An important improvement has recently been made by which the same skip which elevates the material also transports the material horizontally, a single device doing the work which previously required two machines.

That the skip may be able to carry its load both vertically and horizontally without spilling, a radical change has been made in the form of its construction. The ordinary skip is simply a box with open top and equipped with four wheels and a hinged bale. The improved skip, as Fig. 1 shows, has an opening in the upper portion of the front side for receiving its load and

single- or double-hinged doors on the opposite side for discharging the load when the skip is running on a horizontal track.

The filling of the skip is accomplished preferably by a chute from a hopper.

The doors or valves of the skip are held in closed position by a latch. Discharging of the skip's load is accomplished by the tripping of this latch. The latch trip may be easily shifted along the track as required. A further improvement consists in having the trip carried on a traveling frame, which is moved back and forth by a hand winch conveniently placed.

The entire weight of the skip and half of its load is balanced by a counterweight which operates only during the vertical motion of the skip. In lowering the empty skip, the motor works to raise the counterweight, doing the same amount of work as in hoisting. As the weight of the skip is frequently as great as that of the load itself, this arrangement in such a case makes it possible to reduce the size of the motor and the unbalanced strains in the hoisting machine to one-quarter, in the ordinary unbalanced hoist, or to one-half of that for the less common type of double hoist.

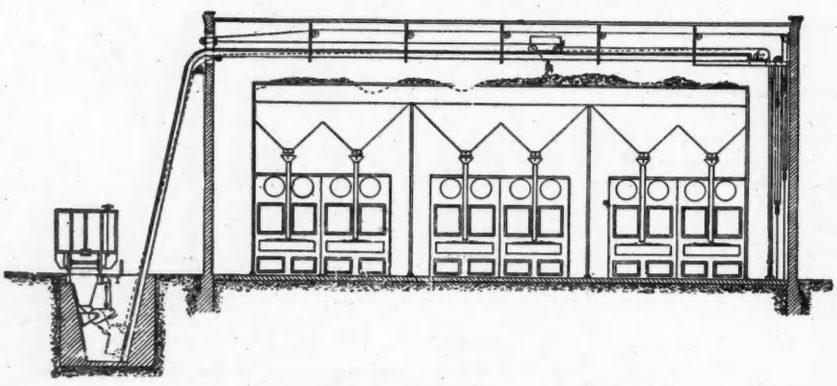


FIG. 2. BALANCED SKIP-HOIST TRANSPORTER

On reaching the top of the vertical rise, the skip engages and carries along with it a bar which is connected by cable to a third counterweight which operates to pull the skip backward after being discharged.

Automatic switches reverse the motor at both ends of the skip's run. By this means, in combination with the automatic filling device, the skip-hoist is made entirely automatic in operation and requires only the occasional services of an operator to keep the machinery oiled and to shift the traveling tripper when this is used.

The skip may be of any suitable capacity and the height of lift and length of run of any reasonable distance, and a skip of two tons capacity will handle 150 tons of coal per hour. The equipment is extremely simple, the cost of maintenance and repairs is reduced to a minimum, and the amount of power wasted by friction is very small. The size of the motor is reduced by one-half, its current demand evened up, and automatic operation reduces the expense required for its attendance to a minimum.

Non-Destructive Belt Joining Solves Unusual Problem

The problem of handling of hot cement clinkers at a temperature of 200 deg. and over was solved at the plant of the Standard Portland Cement Co., Leeds, Ala., in an interesting and cost-reducing manner, by using Goodyear Hy-temp rubber conveyor belt running at an incline of 12 deg., so that the lower pulley dipped into a trough of water, thus carrying a film of cold water upon the belt, on to which the hot clinker from the loading hopper was deposited.

In order to join the belt so that the belt's full strength would be retained, and in a way which would withstand the extremes of temperature, the wear on the pulleys, and the abrasion of the clinker, Crescent belt fasteners were adopted. These brought the belt ends tightly together in a snug joint, which made the belt practically endless on the pulley side, so there was no opportunity for clinker ash to get into the joint and abrade the belt ends. By this method of joining, no metal came in contact with the pulleys to cause wear, and a permanent joint was thus assured. Moreover, the exceptional strength of the heads of the Crescent rivets and the formation of "Crescent Plates" prevented destruction of belt joint through abrasion by the clinker. In six months of operation this conveyor has carried 61,000 tons of clinker, and the Standard Portland Cement Co. credits it with a saving of $300 in belt cost alone.

Not alone on heavy drives, such as tube mill drives, Griffin mills, crushers, and heavy conveyors, are Crescent belt fasteners successfully used, but also on lighter drives of all kinds where dependability is an economic factor, as they assure continuous production. The Crescent Belt Fastener Co., 381 Fourth Ave., New York, has published a new handbook illustrating Crescent belt fasteners in use on many different kinds of belting and under different conditions, and giving full data regarding their use. It will be gladly sent upon request.

TRADE CATALOGS

Hand Drills.—Ingersoll-Rand Co. are offering a fourth type of their "Jackhamer" drills, which is smaller and lighter than others of similar construction. Its weight is but 21½ lb., and it is recommended for bench work in soft stone quarries, trimming in metal mines and pop-hole work in open-pit workings. It is listed as BAR-33.

Brass—The Bridgeport Brass Co., Bridgeport, Conn., has issued an illustrated book of 78 pp., entitled "Seven Centuries of Brass Making." The book describes and illustrates in detail the art of brass making from early times up to the most modern practices, including the electric casting shops. The important steps in the making of tubes, sheets, rods, and wire are also shown. Following the description of the Bridgeport shops, the properties of brass as affected by composition, cold-working, and heat treatment are discussed. The arrangement of the material is excellent, and the issue constitutes a valued contribution to the history of the brass-making industry.

Centrifugal pumps of the single-stage and multi-stage types for various services are described in a handsomely illustrated catalog just issued by the De Laval Steam Turbine Co., Trenton, N. J. Manufacture is on an interchangeable basis, permitting of the supplying of finished repair parts made to accurate dimensions. The present publication describes these and other details, and also explains fully the use of pump characteristic curves in adapting pumps to various services, the adaptation of centrifugal pumps to different types of drives, and give the information required by the manufacturer in order to design a pump to meet given conditions. Formulas and tables for calculating horsepowers, efficiencies, the readings of Venturi meters, friction in pipe lines, and similar data ore also given.

Lighting Industrial Interiors

The Detroit Graphite Co., Detroit, Mich. has recently issued a bulletin, "Lighting Industrial Interiors," which calls attention to the adoption of many fixed principles by illuminating engineers and executives in relation to industrial lighting. As a means of reducing the costs of artificial lighting and accidents, and as an aid to sanitation and general conditions, the use of white paint for interiors is highly commendable, and the excellent qualities which are attributed to "Sta-White," a product manufactured by the Detroit Graphite Co., will be of considerable interest to operators of various industrial plants. In the mining field, the use of such a paint has proved very successful at laboratories, shops, mills, charge houses, and hoist and boiler rooms.